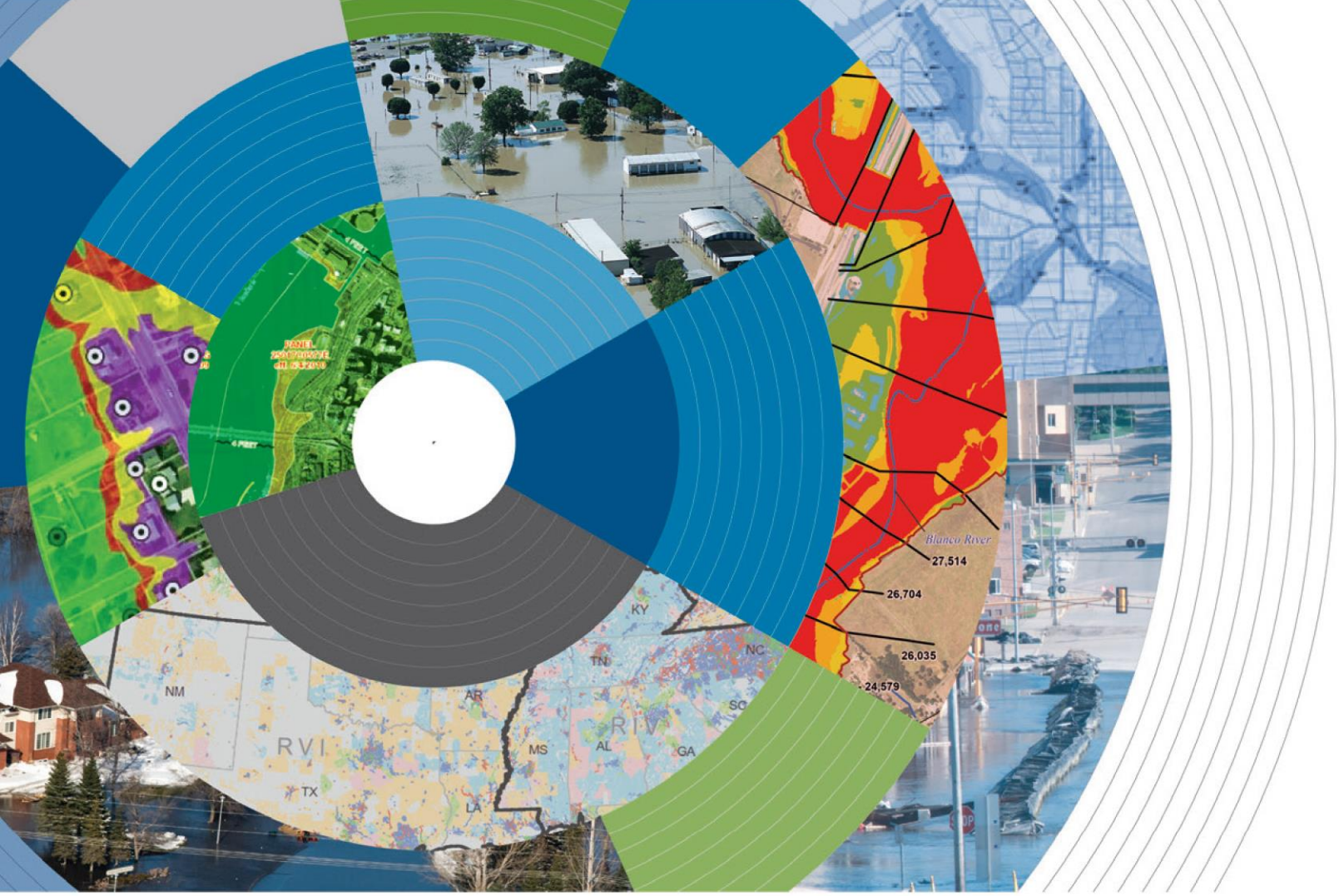


Flood Risk Report

Toledo Bend Reservoir Watershed

HUC-8 12010004

FEMA CASE NUMBER: 22-06-0012S

July 2023

FEMA

Project Area Community List in Scope

Community Name
Caddo Parish (Unincorporated Areas)
DeSoto Parish (Unincorporated Areas)
Natchitoches Parish (Unincorporated Areas)
Sabine Parish (Unincorporated Areas)
Village of Converse
Village of Grand Cane
Town of Keachi
Town of Logansport
Village of Longstreet
City of Mansfield
Town of Many
Village of Noble
Village of Pleasant Hill
Village of South Mansfield
Village of Stanley
Town of Zwolle

Flood Risk Report History

Version Number	Version Date	Summary
v1.0	7/10/2023	Discovery and Flood Risk Report

Preface

The Department of Homeland Security, Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides states and local communities with flood risk information, datasets, risk assessments, and tools that they can use to increase their resilience to flooding and better protect their residents. By pairing accurate floodplain maps with risk assessment tools and planning and outreach support, Risk MAP transforms the traditional flood mapping efforts into an integrated process of identifying, assessing, communicating, planning for, and mitigating flood-related risks.

The Flood Risk Report (FRR) is one of the tools created though the Risk MAP program. A FRR provides non-regulatory information to help local officials, floodplain managers, planners, emergency managers, and others. Local, federal, and state officials can use the information in the FRR to establish a better understanding of their flood risk, take steps to mitigate those risks, and communicate those risks to residents and local businesses.

The FRR serves as a guide when communities update local hazard mitigation plans (HMPs), community comprehensive plans, and emergency operations and response plans. It is meant to communicate risk to officials and inform them of the modification of development standards, as well as assist in identifying necessary or potential mitigation projects. The FRR extends beyond community limits to provide flood risk data for the Toledo Bend Reservoir watershed.

Flood risk is always changing, and studies, reports, or other sources may be available that provide more comprehensive information. This report is not intended to be the regulatory nor the final authoritative source of all flood risk data in the watershed. Rather, it should be used in conjunction with other data sources to provide a comprehensive picture of flood risk within the project area.

Contents

Executive Summary **1**
About the FEMA Risk Mapping, Assessment, and Planning (Risk MAP) Program 1
About the Toledo Bend Reservoir Watershed 3
Introduction **4**
Flood Risk 4
Watershed Basics 5
Project Phases and Map Maintenance **12**
Background 12
How are FEMA's Flood Hazard Maps Maintained? 12
General Flood Risk Project Phases **14**
Phase Zero: Investment 14
Phase One: Discovery 15
Phase Two: Risk Identification and Assessment 16
Phase Three: Regulatory Products Update 16
Toledo Bend Reservoir Watershed Risk MAP Project **18**
Watershed Selection Factors 18
Phase Zero – Base Level Engineering (BLE) – Toledo Bend Reservoir Watershed (2019) **22**
Phase One – Discovery: Toledo Bend Reservoir Watershed **24**
Data Gathering 24
Pre-Discovery Engagement Efforts 27
Discovery Meeting 28
Watershed Findings and Project Prioritizations 29
Future Investments Decisions 39
Next Steps 39
Appendix I: Additional Data **41**
Appendix Figures 42
Flood Risk Map 59
Pre-Discovery Map 61
Discovery Map 63
Post-Discovery Map 65
Pre-Discovery Newsletter 67
Pre-Discovery Meeting Slides 69
Discovery Findings Webinar Slides 96
Appendix II: Community-Specific Reports **139**

Snapshots 140
Appendix III: Base Level Engineering Report 175
Appendix IV: Resources 209
FEMA Points of Contact 212
State Partners 213
Governor's Office of Homeland Security and Emergency Preparedness 213
Louisiana Department of Transportation and Development (LADOTD) 213
Louisiana Floodplain Management Association (LFMA) 214
Certified Floodplain Manager (CFM) Certification 214
Interactive Preliminary Data Viewer [KS1] 214
Estimated Base Flood Elevation (BFE) Viewer 215
Map Service Center – Available Map Data 215

Executive Summary

The Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides communities with flood information to help them understand their current flood risk and make informed decisions about taking action to become stronger and more resilient in the face of future risk. The Risk MAP process provides communities with new or improved information about their flood risk based on watershed models that use information from local, regional, state, and federal sources. Communities can use the resulting tools and data to enhance mitigation plans and better protect their residents.

This report is one such tool for communities impacted by an updated flood hazard analysis of the Toledo Bend Reservoir Hydrologic Unit Code 8 (HUC-8) watershed. The FRR has two goals: (1) **inform communities of their risks** related to certain natural hazards, and (2) **enable communities to act** to reduce their risk. It is intended to assist federal, state, and local officials with the following:

- Updating local Hazard Mitigation Plans and community comprehensive plans
- Updating emergency operations and response plans
- Communicating risk
- Informing the modification of development standards
- Identifying mitigation projects.

Most important, during this phase of the process, communities are encouraged to review the flood hazard changes closely and provide feedback to FEMA Region 6 based on their local knowledge and any additional data available.

About the FEMA Risk Mapping, Assessment, and Planning (Risk MAP) Program

Flood risk is continually changing over time due to factors such as new building and development and weather patterns. The goal of FEMA's Risk MAP program is to work with federal, state, tribal, and local partners to identify and reduce flood risk across communities. These projects are conducted using watershed boundaries and bring together multiple communities to identify broader mitigation actions and create consistency across the watershed. The program provides resources and support that are tailored to each community to help mitigate their risk and work towards a reduction in risk and future loss.

Through coordination and data sharing, the communities in the watershed work as partners in the mapping process. In addition to providing data, the communities can also provide insight into flooding issues and flood prevention within their areas. To prepare for a future study and assist in mitigation, FEMA provides several data sources, including information from the community, such as the following:

- Areas of repeated flooding and insurance claims
- Future development plans
- Areas of low water crossings
- High water marks from recent flooding events
- Areas of evacuation during high water
- Master drainage plans, flood risk reduction projects, and large areas of fill placement
- Local flood studies
- Other flood risk information

For more information about ways communities can act or take advantage of available resources, please review the attached appendices.

FEMA provides communities with Base Level Engineering (BLE) data for select watersheds during the Risk MAP process. BLE is a form of automated hydrologic and hydraulic modeling which, when completed, can provide modeled flood hazard data for all flooding sources within the HUC-8 watershed. Knowing the extent of flooding during the 1-percent-annual-chance flooding event supports both risk reduction efforts and more resilient community planning. Completed BLE data is provided to watershed communities for planning, risk communication, floodplain management, and permitting activities, and to inform future flood study needs. BLE is large scale watershed-based modeling that lacks the detail of Zone AE modeling such as road crossings and the effects of routing storage. BLE does not replace Zone AE data and should be used for comparison purposes only in these areas.

For the Toledo Bend Reservoir watershed BLE datasets and products, see Mapping Information Platform (MIP) case number 20-06-0051S, or visit the Interagency Flood Risk Management (InFRM) estimated Base Flood Elevation (BFE) Viewer. For a review of these BLE products, see Appendix III.

About the Toledo Bend Reservoir Watershed

The Louisiana Department of Transportation and Development (LADOTD) became a FEMA Cooperating Technical Partner (CTP) in Fiscal Year 2015 (FY15). In FY21, LADOTD contracted with FEMA to provide Risk MAP Discovery for the portion of the Toledo Bend Reservoir HUC-8 watershed located in Louisiana. The project area covers the portions of the parishes included within the Toledo Bend Reservoir HUC-8 watershed: Sabine, Caddo, Natchitoches, and DeSoto Parishes. Though some hydrologically and hydraulically significant data in the Texas section of the HUC is included to provide a full picture of engineering considerations in the watershed. It is important to note that only the part of the HUC inside the Louisiana boundary is scoped for this contract. Location maps covering the study area can be found in Appendix I.

The oldest effective FEMA flood hazard mapping for the parishes within the Toledo Bend Reservoir watershed were released in the 1970s. Most of the parishes received modernized parish-wide Digital Flood Insurance Rate Maps (DFIRMs) as part of FEMA's Map Modernization (MAP MOD) program in the 2010s. However, Sabine Parish still has paper maps with flood hazard data developed during the 1990s.

According to the 2019 National Land Cover Data, approximately 81 percent of the area in the Toledo Bend Reservoir watershed is undeveloped, including woody wetlands, cropland, pastures, evergreen forest, and deciduous forest. Roughly six percent of the area is developed, and the remaining 13 percent is open water.

The Toledo Bend Reservoir runs through a diversity of landscapes and physical conditions, with dams (e.g. the Toledo Bend Reservoir Dam) and urbanized towns, villages, and unincorporated areas. Over the past two decades, the study area has experienced an increase in occurrence of flash floods. In 2017, Hurricane Harvey forced the dam in the Toledo Bend Reservoir to be opened and caused an overall total of $125 billion dollars in damages in its wake. Over the past century, the population has decreased slightly in the watershed. Additional background information for the watershed is depicted in Appendix I.

In 2021, FEMA authorized LADOTD to leverage the previously completed BLE data to perform Discovery in the Toledo Bend Reservoir watershed. The goal of the Discovery project is to work closely with communities to better understand local flood risks, mitigation efforts, and other topics to spark watershed-wide discussions about increasing resilience to flooding.

Introduction

Flood Risk

Floods are naturally occurring phenomena that can and do happen almost anywhere. In its most basic form, a flood is an accumulation of water over a normally dry area. Floods become hazardous to people and property when they inundate an area where development has occurred, causing losses. Mild flood losses may have little impact on people or property, such as damage to landscaping or the accumulation of unwanted debris. Severe flood losses can destroy buildings and crops and cause severe injuries or death.

Calculating Flood Risk

It is not enough to simply identify where flooding may occur. Even if people know where a flood might occur, they may not know the level of flood risk in that area. The most common method for determining flood risk, also referred to as vulnerability, is to identify both the probability and the consequences of flooding:

> **Flood Risk** (or Vulnerability) **= Probability x Consequences**; where
>
> **Probability** = the likelihood of occurrence
>
> **Consequences** = the **estimated** impacts associated with the occurrence on life, property, and infrastructure

The probability of a flood is the likelihood that it will occur. The probability of flooding can change based on physical, environmental, and/or engineering factors. Factors affecting the probability that a flood will have an impact on an area range from changing weather patterns to the existence of mitigation projects. The ability to assess the probability of a flood, and the level of accuracy for that assessment, are also influenced by modeling methodology advancements, better knowledge, and longer periods of record for the body of water in question.

The consequences of a flood are the estimated impacts associated with its occurrence. Consequences relate to human activities within an area and how a flood affects the natural and built environment.

The FRR has two goals: (1) inform communities of their risks related to certain natural hazards, and (2) enable communities to act to reduce their risk. The information within this Risk Report is intended to assist federal, state, and local officials to:

- **Communicate risk** – Local officials can use the information in this report to communicate with property owners, business owners, and other residents about risks and areas of mitigation interest.
- **Update local hazard mitigation plans and community comprehensive plans** – Planners can use risk information to develop and/or update hazard mitigation plans, comprehensive plans, future land use maps, and zoning regulations. For example, zoning codes can be changed to provide for more appropriate land uses in high-hazard areas.
- **Update emergency operations and response plans** – Emergency managers can identify high-risk areas for potential evacuation and low-risk areas for sheltering. Risk assessment information may show vulnerable areas, facilities, and infrastructure for which continuity of operations plans, continuity of government plans, and emergency operations plans would be essential.

- **Inform the modification of development standards –** Planners and public works officials can use information in this report to support the adjustment of development standards for certain locations.
- **Identify mitigation projects –** Planners and emergency managers can use this risk assessment to determine specific mitigation projects of interest. For example, a floodplain manager may identify critical facilities that need to be elevated or removed from the floodplain.

This FRR focuses on the Risk MAP BLE and the Discovery projects. It showcases risk assessments, which analyze how a flood hazard affects the built environment, population, and local economy to identify mitigation actions and develop mitigation strategies.

The information in this report should be used to identify areas for mitigation projects as well as for additional efforts to educate residents on the hazards that may affect them. The areas of greatest hazard impact are identified in the Areas of Mitigation Interest section of this report, which can serve as a starting point for identifying and prioritizing actions a community can take to reduce its risks.

Watershed Basics

Background

The Toledo Bend Reservoir watershed is located on the border of Louisiana and Texas and covers portions of Sabine, Caddo, Natchitoches, and DeSoto Parishes as well as parts of Panola, Shelby, San Augustine, Sabine, and Newton Counties. See Figure 1 for an overview map of the Toledo Bend Reservoir watershed. The watershed impacts 16 communities which includes an estimated 49,752 people across Louisiana and Texas. The total watershed size is approximately 2,370 square miles (sq. mi.). The watershed size within the Louisiana state limits is approximately 1110 sq. mi. of which approximately 300 sq. mi. is mapped floodplain. See Appendix I for figures showing effective floodplain locations in the Toledo Bend Reservoir watershed.

The BLE study covered the entirety of the HUC-8 watershed. However, LADOTD's Discovery effort focuses on the communities in Louisiana. Information relevant to flooding sources within the watershed but outside the Louisiana state limits, including dams, levees, flash flood frequencies, and rainfall totals, will still be represented in the report for a fuller depiction of the watershed risk.

The Sabine River is the primary river that flows from east of Longview, Texas, to the northwest region of the Toledo Bend Reservoir. There are approximately 1,368 stream miles in the Toledo Bend Reservoir watershed that drain all the 57 HUC-12 watersheds within the study area. Flooding is highly dependent on rainfall and often follows tropical thunderstorm events hitting the watershed. Per USClimateData.com, there is an increase in rainfall moving from north to south across the watershed with an average rainfall of 52 inches in Logansport to 58 inches near South Toledo Bend.

The Toledo Bend Reservoir watershed is mainly in the South Central Plains ecoregion of Western Louisiana that consists of the following subregions: Tertiary Uplands and Southern Tertiary Uplands. Deposits in the area are mainly Eocene clays, silts, and sands. The soils of the area consist of moderately well drained Ultisols and Alfisols that have sandy and loamy surface textures. Commercial pine plantations can be found in many areas of the ecoregion. Native trees of the area consist of variations of pine trees, oak trees, hickories, and sweetgums, but the South Central Plains ecoregion of Louisiana also holds many rare species of animals and plants for the state and globe. The ecoregion's landscape is cut by several small

streams and the flow is often intermittent in the summer and early fall. The land use is predominantly timber, but also has livestock grazing, poultry production, and oil and gas production.

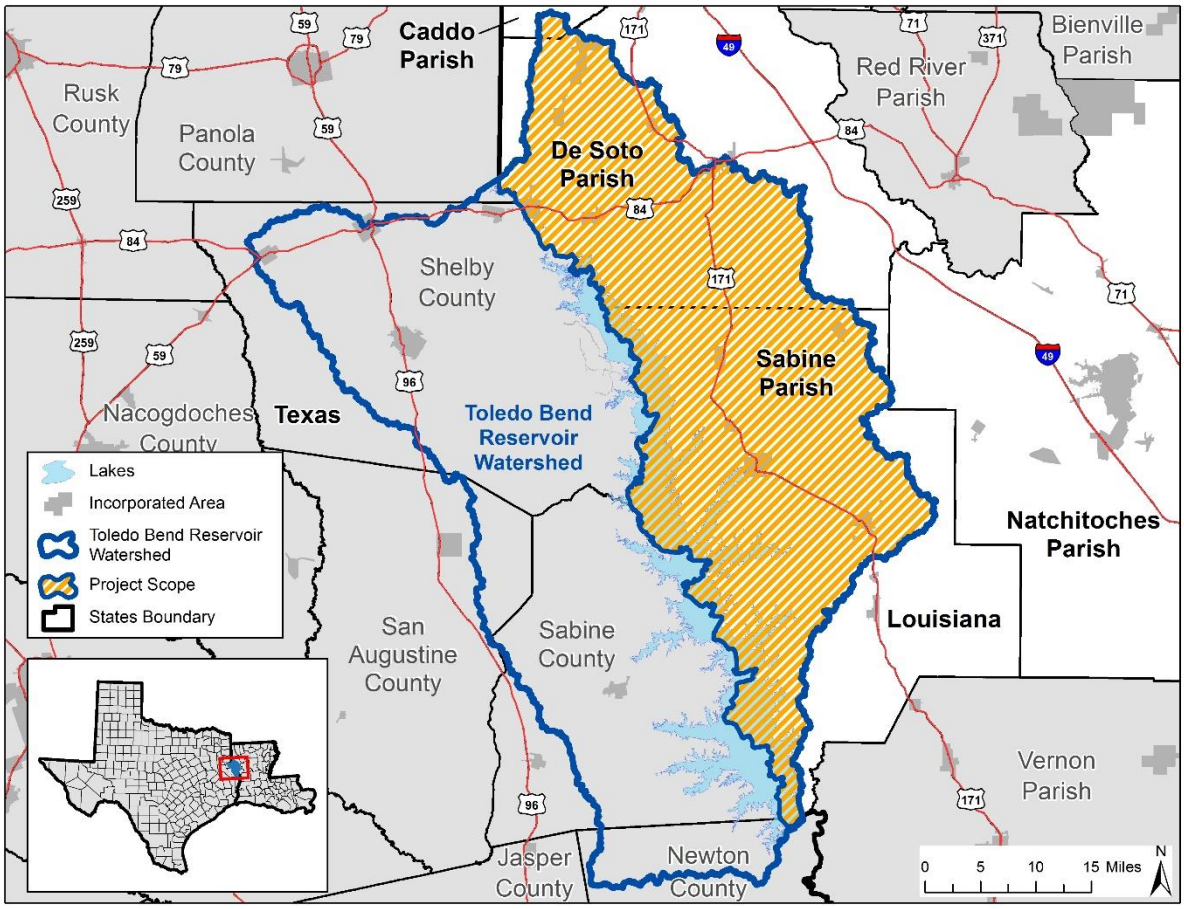


Figure 1: Overview map of the Toledo Bend Reservoir watershed

The Toledo Bend Reservoir watershed represents a large holding station for water on the state line of Louisiana and Texas. Much of the floodplain in the Toledo Bend Reservoir watershed is in the unincorporated areas of Shelby County, Sabine County, and Sabine Parish. The mainstem of the Sabine River and its many tributaries have several dams along their lengths, including the Toledo Bend Dam on the south end of the Toledo Bend Reservoir, located in Newton County, Texas.

Intense, localized thunderstorms and frontal cyclone storms in the early March to mid-July months cause most of the flooding issues in the Toledo Bend Reservoir watershed area. Flash flooding occurs throughout the watershed, with the silty clay loam and sandy subsoils often well drained during large rain events. Most parishes that have recorded flood events within the Toledo Bend Reservoir watershed have little to no flood damage. The majority of flooding is in the Village of Pleasant Hill, Town of Zwolle, and Town of Many. Among the three areas, there are approximately four years between successive damaging flood events. The parishes within the Toledo Bend watershed have experienced up to 150 flash floods between 1996 and 2020. Figure 2 shows the number of flash floods per parish in Louisiana and per county in Texas.

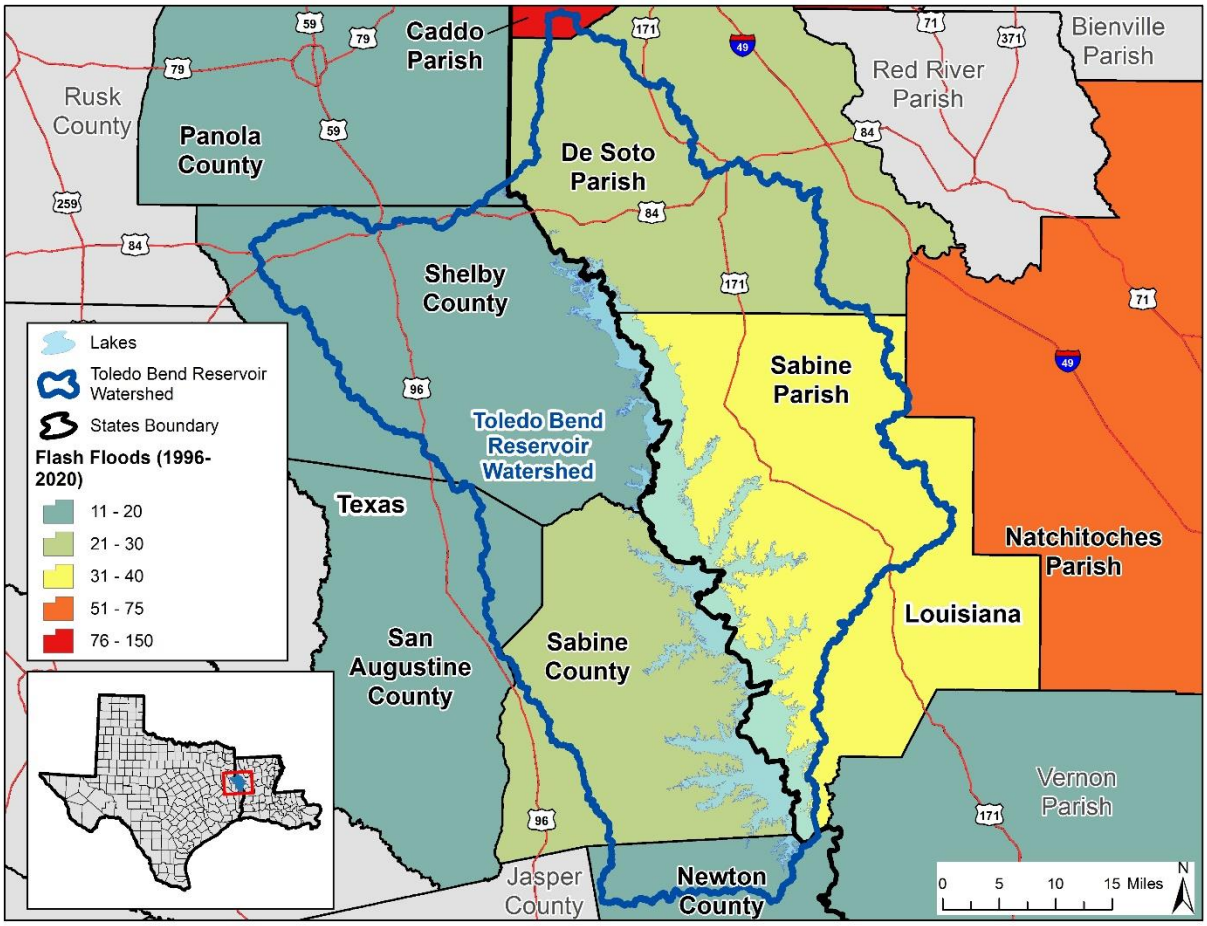


Figure 2: Flash Flood Incidents

Population

A review of land cover changes and population growth patterns in the watershed revealed that little development and a slight decrease in population occurred from 2010 to 2020 in all of the parishes within the Toledo Bend Reservoir watershed. According to the United States Census Bureau, almost every town and village decreased in population between 2010 and 2020. The study area's population within Louisiana dropped from 34,880 to 33,069, a difference of about five percent. In comparison, the total population of Louisiana increased by 2.7 percent in the same timeframe.

Since 2010, DeSoto Parish's population has increased by about 0.6 percent. All other communities have declined in population, with Caddo Parish serving approximately 11 percent fewer people and Sabine Parish serving approximately seven percent fewer people. Assuming the average decrease rate experienced between 2010 and 2020, it is possible that the population may decrease by another 2.5 percent between 2020 and 2025. See Figure 5 and Figure 7 in Appendix I for a watershed population density map and a population change map, respectively.

Watershed Land Use

The Toledo Bend Reservoir watershed is predominately undeveloped, rural areas. The north portion of the study watershed is mainly woody wetlands, cultivated crops, pasture, and evergreen forests. Excluding the combined areas of previously developed land and open water, roughly 899 sq. mi. of the Toledo Bend Reservoir watershed has the potential for new development. Table 1 shows both population

and land use for the Louisiana study area in the Toledo Bend Reservoir watershed. See Figure 6 in Appendix I for a land cover map.

Table 1: Population and Area Characteristics [1]

Risk MAP Project	Total Population in Louisiana Study Area (2020)	Average % Population Growth Yearly (2010-2020)	Predicted Population (by 2025)	Land Area (sq. mi.)	Developed Area (sq. mi.)	Open Water (sq. mi.)
Toledo Bend Reservoir Watershed (HUC-8 12010004)	33,069	-0.5	32,199	1,110*	64	147

*Total Land Area includes land and water

National Flood Insurance Program (NFIP) Status and Regulations

To be a participant of the NFIP, all interested communities must adopt and submit floodplain management ordinances that meet or exceed the minimum NFIP regulations. These regulations can be found in the Code of Federal Regulations and most of the community ordinance requirements are in Title 44 parts 59 and 60. The level of regulation depends on the level of information available and the flood hazards in the area. The levels are as follows:

- A: The Federal Emergency Management Agency (FEMA) has not provided any maps or data – 60.3(a)
- B: Community has maps with approximate A Zones – 60.3(b)
- C: Community has a Flood Insurance Rate Map (FIRM) with Base Flood Elevations (BFE) – 60.3(c)
- D: Community has a FIRM with BFEs and floodways – 60.3(d)
- E: Community has a FIRM that shows coastal high hazard areas (V Zones) – 60.3(e)

To help mitigate the risk to areas where increased population and development are expected, communities can adopt (or exceed) the minimum standards of the NFIP. This is recommended as a proactive strategy to manage construction within the floodplain and avoid negative impacts to existing and future development. The Association of State Floodplain Managers (ASFPM) No Adverse Impact Floodplain Management is a good example.

To increase mitigation efforts and community flood awareness through potentially discounted premium rates, an NFIP community that has adopted more stringent ordinances or is actively completing mitigation and outreach activities is encouraged to consider joining the Community Rating System (CRS). The CRS is a voluntary incentive-based program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions.

Communities can review their current ordinances and reflect potential flood hazard changes by adopting updated ordinances early. This action can reduce future flood losses by affecting how substantial improvements or new construction are regulated. Figure 10 in Appendix I illustrates the NFIP flood losses within the project scope.

[1] Data obtained from the U.S. Census Bureau; ESRI Demographic 5-year Projections; and National Land Cover Database

Hazard Mitigation Plan (HMP)

State and local governments must develop and adopt HMPs to be eligible for certain types of funding. To remain eligible, communities need to update and resubmit their plans every five years for FEMA approval. HMPs are created to increase education and awareness, identify strategies for risk reduction, and identify other ways to develop long-term strategies to reduce risk and protect people and property.

Caddo and Natchitoches Parish have no approved HMPs, but are currently in development. DeSoto Parish and the city of Mansfield, towns of Logansport and Keachi, and villages of Grand Cane, Longstreet, South Mansfield, and Stanley participate in the DeSoto Parish's HMP, which is set to expire in February 2027. Sabine Parish and the towns of Many and Zwolle along with the villages of Converse, Nobel, and Pleasant Hill participate in the Sabine Parish's HMP, which is set to expire in February 2027.

HMPs effectively allow for FEMA to assess hazards identified through local, state, and federal partnerships and mitigation action items that communities have identified. These HMPs were used in the compilation and preparation of this report.

Community Rating System (CRS)

CRS is a voluntary incentive-based program that recognizes and encourages community floodplain management activities that communities undertake in addition to the minimum requirements they must meet when joining the NFIP. Individuals that carry flood insurance in a community that participates in the CRS program can receive a discount on their flood insurance premium. Discounts can range from 5 to 45 percent. As of March 2023, Caddo Parish is the only CRS participating community within the watershed. Table 2 depicts NFIP and CRS participation status and provides an overview of the effective flood data availability within the study area.

Table 2: NFIP and CRS Participation [2]

Risk MAP Project	Participating NFIP Communities/ Total Communities	Number of CRS Communities	CRS Rating Class Range	Average Years since FIRM Update	Level of Regulations (44 CFR 60.3)
Toledo Bend Reservoir Watershed (HUC-8 12010004)	14/16	1	9	17	60.3 (b) 60.3 (c)

Flood Insurance Rate Maps (FIRMs)

The average age of the effective FIRMs within the study watershed is 17 years. The oldest effective map is in Sabine Parish. It is 32 years old and has an effective date of August 5, 1991. The newest effective maps in Natchitoches Parish are eight years old with an effective date of July 6, 2015. As of 2023, all communities except Sabine Parish have modernized parish-wide effective DFIRMs.

[2] Data obtained from FEMA Community Information Systems.

Dams and Levees

As recorded by the United States Army Corps of Engineers (USACE) National Inventory of Dams (NID) datasets and the FEMA DFIRM databases, there are 48 dams in Toledo Bend Reservoir watershed. The largest is the Toledo Bend Dam, located in the northeast corner of Newton County in Texas. It was constructed in 1964 and is used for water supply, recreation, and generating up to 92 megawatts of electrical power. There are eight dams in Sabine Parish, 18 dams in DeSoto Parish, one dam in Caddo Parish, four dams in Newton County, two dams in San Augustine County, 13 dams in Shelby County, two dams in Sabine County within the watershed area. Figure 3 shows locations of dams in the study watershed.

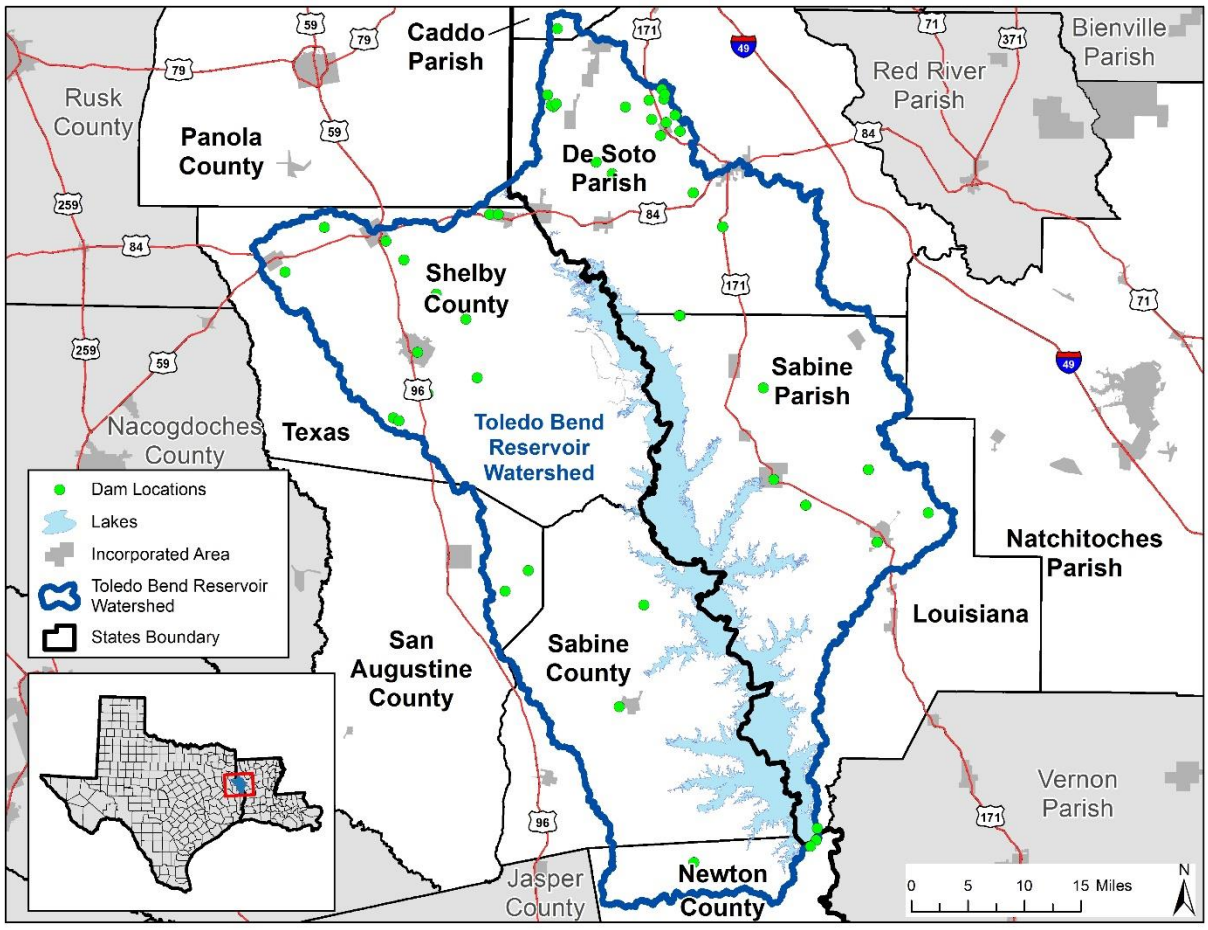


Figure 3: Dam Location Map for Toledo Bend Reservoir watershed

Several dams along numerous streams in the watershed are used to maintain water storage, control flooding, irrigation, fire protection, energy production, or divert flow. Most dams are privately owned, but there are some dams that are owned by local government agencies such as the Sabine River Authority (SRA). Of the Louisiana dams, 87 percent are classified as low hazard. The Natural Resources Conservation Service (NRCS) has designed four dams in the study watershed. These NRCS dams are mainly used for flood control, to prevent erosion damage, to improve water supply and irrigation, and to create a habitat for wildlife. There are no levees in the Toledo Bend Reservoir watershed.

Table 3 provides the characteristics of the dams identified in the entire HUC-8 watershed. The Toledo Bend Dam and the Toledo Bend Saddle Dikes 1, 2, and 3 are situated along the manmade Toledo Bend Reservoir and can store up to 5,097,500 acre-feet of water within the reservoir.

Table 3: Risk MAP Project Dam Characteristics[3]

Risk MAP Project	Total Number of Identified Dams	Number of Dams Requiring EAP	Percentage of Dams without EAP	Average Years since Inspection	Average Storage (acre-feet)
Toledo Bend Reservoir Watershed (HUC-8 12010004)	48	6	0%	5*	111,135

*Date of last inspection not provided for all records as of March 2023

[3] Data obtained from USACE National Inventory of Dams

Project Phases and Map Maintenance

Background

FEMA manages several risk analysis programs, including Flood Hazard Mapping, National Dam Safety, the Earthquake Safety Program, Multi-Hazard Mitigation Planning, and the Risk Assessment Program, all of which assess the impact of natural hazards and lead to effective strategies for reducing risk. These programs support the Department of Homeland Security's objective to "strengthen nationwide preparedness and mitigation against natural disasters."

FEMA manages the NFIP, which is the cornerstone of the national strategy for preparing American communities for flood hazards. In the nation's comprehensive emergency management framework, the analysis and awareness of natural hazard risk remains challenging. A consistent risk-based assessment approach and a robust communication system are critical tools to ensure a community's ability to make informed risk management decisions and take mitigation actions. Flood hazard mapping is a basic and vital component for a prepared and resilient nation.

> *Flood-related damage between 1980 and 2013 totaled $260 billion [dollars], but the total impact to our Nation was far greater—more people lose their lives annually from flooding than any other natural hazard.*
>
> *FEMA, "Federal Flood Risk Management Standard (FFRMS)" (2015)*

In Fiscal Year 2009, FEMA's Risk MAP program began to synergize the efforts of federal, state, and local partners to create timely, viable, and credible information identifying natural hazard risks. The intent of the Risk MAP program is to share resources to identify the natural hazard risks a community faces and ascertain possible approaches to minimizing them. Risk MAP aims to provide technically sound flood hazard information to be used in the following ways:

- To update the regulatory flood hazard inventory depicted on FIRMs and the National Flood Hazard Layer
- To provide broad releases of data to expand the identification of flood risk (flood depth grids, water-surface elevation grids, etc.)
- To support sound local floodplain management decisions
- To identify opportunities to mitigate long-term risk across the nation's watersheds

How are FEMA's Flood Hazard Maps Maintained?

FEMA's flood hazard inventory is updated through several types of revisions.

Community-submitted Letters of Map Change (LOMCs)

First and foremost, FEMA relies heavily on the local communities that participate in the NFIP to carry out the program's minimum requirements. These requirements include the obligation for communities to notify FEMA of changing flood hazard information and to submit the technical supporting data needed to update the FIRMs.

Although revisions may be requested at any time to change information on a FIRM, FEMA generally will not revise an effective map unless the changes involve modifications to Special Flood Hazard Areas (SFHAs). Be aware that the best floodplain management practices and proper assessments of risk result when the flood hazard maps present information that accurately reflects current conditions.

Under the current minimum NFIP regulations, a participating community commits to notifying FEMA if changes take place that will affect an effective FIRM no later than 6 months after project completion.

Section 65.3, Code of Federal Regulations

Letters of Map Amendment (LOMAs)

The scale of an effective FIRM does not always provide the information required for a site-specific analysis of a property's flood risk. FEMA's LOMA process provides homeowners with an official determination on the relation of their lot or structure to the SFHA. Requesting a LOMA may require a homeowner to work with a surveyor or engineering professional to collect site-specific information related to the structure's elevation; it may also require the determination of a site-specific BFE. Fees are associated with collecting the survey data and developing a site-specific BFE. Local surveying and engineering professionals usually provide an Elevation Certificate to the homeowner, who can use it to request a LOMA. A successful LOMA may remove the Federal mandatory purchase requirement for flood insurance, but lending companies may still require flood insurance if they believe the structure is at risk.

FEMA-Initiated Flood Risk Project

Each year, FEMA initiates a number of Flood Risk Projects to create or revise flood hazard maps. Because of funding constraints, FEMA can study or restudy only a limited number of communities, parishes, or watersheds each year. As a result, FEMA prioritizes study needs based on a cost-benefit approach whereby the highest priority is given to studies of areas where development has increased, and the existing flood hazard data has been superseded by information based on newer technology or changes to the flooding extent. FEMA understands communities require products that reflect current flood hazard conditions to best communicate risk and implement effective floodplain management.

Flood Risk Projects may be delivered by FEMA or one of its Cooperating Technical Partners (CTPs). The CTP initiative is an innovative program created to foster partnerships between FEMA and participating NFIP communities, as well as regional and state agencies. Qualified partners collaborate in maintaining up-to-date flood maps. In FEMA Region 6, which includes the State of Louisiana, CTPs are generally statewide agencies that house the State Floodplain Administrator. However, some Region 6 CTPs are also large river authorities, flood control districts, regional planning agencies, or cities. They provide enhanced coordination with local, state, and federal entities, engage community officials and technical staff, and provide updated technical information that informs the national flood hazard inventory.

Risk MAP has modified FEMA's project investment strategy from a single investment by fiscal year to a multi-year phased investment, which allows FEMA to be more flexible and responsive to the findings of the project as it moves through the project lifecycle. Flood Risk Projects are funded and completed in phases.

General Flood Risk Project Phases

Each phase of the Flood Risk Project provides both FEMA and its partner communities with an opportunity to discuss the data that has been collected and to determine a path forward. Local engagement throughout each phase enhances the opportunities for partnership, furthers the discussion on current and future risk, and helps identify local projects and activities to reduce long-term natural hazard risk.

Flood Risk Projects may be funded for one or more of the following phases:

- Phase Zero – Investment
- Phase One – Discovery
- Phase Two – Risk Identification and Assessment
- Phase Three – Regulatory Product Update

Local input is critical throughout each phase of a Flood Risk Project. More details about the tasks and objectives of each phase are included below.

Phase Zero: Investment

Phase Zero of a Flood Risk Project initiates FEMA's review and assessment of the inventories of flood hazards and other natural hazards within a watershed area. During the Investment Phase, FEMA reviews the availability of information to assess the current floodplain inventory. FEMA maintains several data systems to perform watershed assessments and selects watersheds for a deeper review of available data and potential investment tasks based on the following factors:

Availability of High-Quality Ground Elevation Data

FEMA reviews readily available and recently acquired ground elevation data. This information helps identify development and earth-moving activities near streams and rivers. Where necessary, FEMA may partner with local, state, and other federal entities to collect necessary ground elevation information within a watershed.



If The National Map - Advanced Viewer can provide high-quality ground elevation data that is both available for a watershed area and compliant with FEMA's quality requirements, FEMA and its mapping partners may prepare engineering data to assess, revise, replace, or add to the current flood hazard inventory.

Mile Validation Status within Coordinated Needs Management Strategy (CNMS)

FEMA uses the CNMS database to track the validity of the flood hazard information prepared for the NFIP. The CNMS database reviews 17 criteria to determine whether the flood hazard information shown on the current FIRM is still valid.



Communities may also inform and request a review or update of the inventory through the CNMS website at https://msc.fema.gov/cnms/. The Coordinated Needs Management Strategy (CNMS) Technical Reference (fema.gov) provides an overview of the online tool. Requests should be directed to the appropriate FEMA Regional Offices for review.

Local Hazard Mitigation Plans

Reviewing current and historic hazard mitigation plans provides an understanding of a community's comprehension of its flood risk and other natural hazard risks. The mitigation strategies within a local

hazard mitigation plan provide a lens to local opportunities and underscore a potential for local adoption of higher standards related to development or other actions to reduce long-term risk.

Cooperating Technical Partner (CTP) State Business Plans
In some states, a CTP generates an annual state business plan that identifies future Flood Risk Project areas that are of interest to the state. The Louisiana Department of Transportation and Development (LADOTD) works to develop user-friendly data. In this project area, FEMA has worked closely with LADOTD to develop the project scope and determine the necessary project tasks.



Communities that have identified local issues are encouraged to indicate their data needs and revision requests to the State CTP so that they can be prioritized and included in the State Business Plans.

Possible Investment Tasks
After a review of the data available within a watershed, FEMA may choose to (1) purchase ground elevation data and/or (2) create some initial engineering modeling against which to compare the current inventory, also known as BLE modeling.

Phase One: Discovery

Phase One, the Discovery Phase, provides opportunities both internally (between the state and FEMA) and externally (with communities and other partners interested in flood potential) to discuss local issues with flooding and examine possibilities for mitigation action. This effort is made to determine where communities currently are with their examination of natural hazard risk throughout their community and to identify how state and federal support can assist communities in achieving their goals.



The Discovery process includes an opportunity for local communities to provide information about their concerns related to natural hazard risks. Communities may continue to inform the project identification effort by providing previously prepared survey data, as-built stream crossing information, and engineering information.

For a holistic community approach to risk identification and mapping, FEMA relies heavily on the information and data provided at the local level. Flood Risk Projects are focused on identifying (1) area where the current flood hazard inventory does not provide adequate detail to support local floodplain management activities, (2) areas of mitigation interest that may require more detailed engineering information than is currently available, and (3) community intent to reduce the risk throughout the watershed to assist FEMA's future investment in these project areas. Watersheds are selected for Discovery based on these evaluations of flood risk, data needs, availability of elevation data, regional knowledge of technical issues, identification of a community-supported mitigation project, and input from federal, state, and local partners.

Possible Discovery Tasks
Discovery may include a mix of interactive webinar sessions, conference calls, informational tutorials, and in-person meetings to reach out to and engage with communities for input. Data collection, interviews, and interaction with community staff and data-mining activities provide the basis for watershed-, community-, and stream-level reviews to determine potential projects that may benefit the communities. A range of analysis approaches are available to determine the extent of flood risk along streams of

concern. FEMA and its mapping partners will work closely with communities to determine the appropriate analysis approach, based on the data needs throughout the community.

These potential projects may include local training sessions, data development activities, outreach support to local communities wanting to step up their efforts, or the development of flood risk datasets within areas of concern to allow a more in-depth discussion of risk.

Phase Two: Risk Identification and Assessment

Phase Two (Risk Identification and Assessment) continues the risk awareness discussion with communities through watershed analysis and assessment. Analyses are prepared to review the effects of physical and meteorological changes within the project watershed. The new or updated analysis provides an opportunity to identify how development has affected the amount of stormwater generated during a range of storm probabilities and shows how effectively stormwater is transported through communities in the watershed.



Coordination with a community's technical staff during engineering and model development allows FEMA and its mapping partners to include local knowledge, based on actual on-the-ground experience, when selecting modeling parameters.

The information prepared and released during Phase Two is intended to promote better local understanding of the existing flood risk by allowing community officials to review the variability of the risk throughout their community. As FEMA strives to support community-identified mitigation actions, it also looks to increase the effectiveness of community floodplain management and planning practices, including local hazard mitigation planning, participation in the NFIP, use of actions identified in the CRS Manual, risk reduction strategies for repetitive loss and severe repetitive loss properties, and the adoption of stricter standards and building codes.



FEMA is eager to work closely with communities and technical staff to determine the current flood risk in the watershed. During the Risk Identification and Assessment phase, FEMA would like to be alerted to any community concerns related to the floodplain mapping and analysis approaches being taken. During this phase, FEMA can engage with communities and review the analysis and results in depth.

Possible Risk Identification and Assessment Tasks

Phase Two may include a mixture of interactive webinars, conference calls, informational tutorials, and in-person meetings to reach out to and engage with communities for input. Flood Risk Project tasks may include hydrologic or hydraulic engineering analysis and modeling, floodplain mapping, risk assessments using Hazus-Multi Hazard software, and preparation of flood risk datasets (water-surface elevation, flood depth, or other analysis grids). Additionally, projects may include local training sessions, data development activities, outreach support to local communities that want to step up their efforts, or the development of flood risk datasets within areas of concern to allow a more in-depth discussion of risk.

Phase Three: Regulatory Products Update

If the analysis prepared in the previous Flood Risk Project phases indicates that physical or meteorological changes in the watershed have significantly changed the flood risk since the last FIRM was printed, FEMA will initiate the update of the regulatory products that communities use for local floodplain management and NFIP activities.

Delivery of the preliminary FIRM and Flood Insurance Study (FIS) report begins another period of coordination between community officials and FEMA to discuss the required statutory and regulatory steps both parties will perform before the preliminary FIRM and FIS report can become effective. As in the previous phases, FEMA and its mapping partners will engage with communities through a variety of conference calls, webinars, and in-person meetings.

Once the preliminary FIRMs are prepared and released to communities, FEMA will initiate the statutory portions of the regulatory product update. FEMA will coordinate a Consultation Coordination Officer meeting and initiate a 90-day comment and appeal period. During this appeal period, local developers and residents may coordinate the submittal of their comments and appeals through their community officials to FEMA for review and consideration.

FEMA welcomes this information because additional proven scientific and technical information increases the accuracy of the mapping products and better reflects the community's flood hazards identified on the FIRMs.

Communities may host or hold Open House meetings for the public. The Open House layout allows attendees to move at their own pace through several stations, collecting information in their own time. This format allows residents to receive one-on-one assistance and ask questions pertinent to their situations or their interests in risk or flood insurance information.

All appeals and comments received during the statutory 90-day appeal period, including the community's written opinion, will be reviewed by FEMA to determine the validity of the appeal. Once FEMA issues the appeal resolution, the associated community and all appellants will receive an appeal resolution letter and FEMA will revise the preliminary FIRM, if warranted. A 30-day period is provided for review and comment on successful appeals. Once all appeals and comments are resolved, the flood map is ready to be finalized.

After the appeal period, FEMA will send community leaders a Letter of Final Determination stating that the preliminary FIRM will become effective in six months. The letter also discusses the actions each affected community participating in the NFIP must take to remain in good standing in the NFIP.

After the preceding steps are complete and the six-month compliance period ends, the FIRMs are considered effective maps and new building and flood insurance requirements become effective.

The following sections describe FEMA's Risk MAP investment in the Toledo Bend Reservoir watershed to date.

Toledo Bend Reservoir Watershed Risk MAP Project

Watershed Selection Factors

All FEMA Risk MAP Project life cycles begin with Phase Zero (Investment) and Phase One (Discovery). The investment in these two phases in the Toledo Bend Reservoir watershed paves the way for the local communities to move towards flooding resilience. FEMA selected and prioritized the watershed for BLE Investment and Discovery with the overall goal of assisting the local governments in identifying flood risks and strengthening their ability to make informed decisions about reducing these risks. Figure 4 shows communities within the Toledo Bend Reservoir watershed.

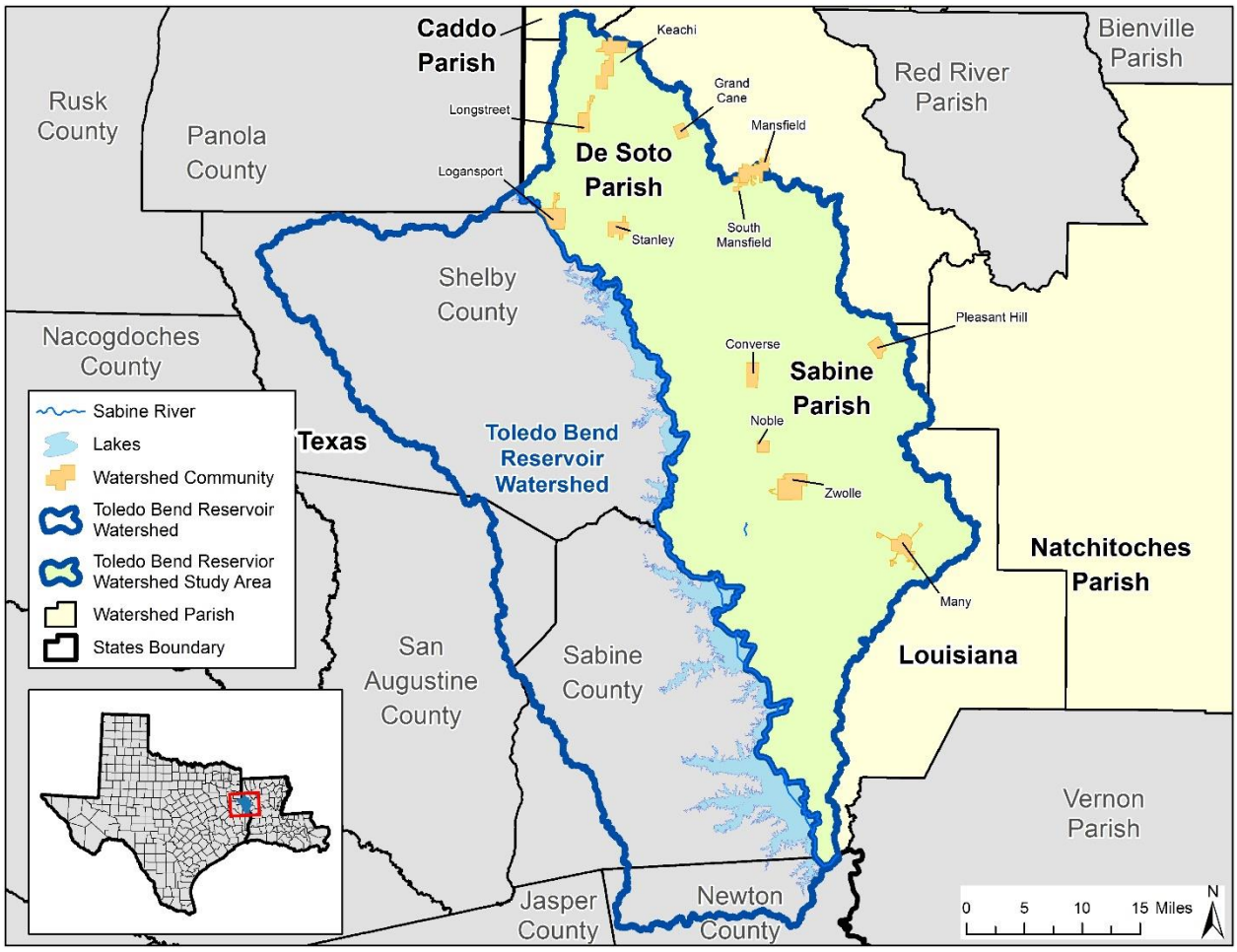


Figure 4: Overview of communities located within the Toledo Bend Reservoir watershed

Many factors and criteria are reviewed for watershed selection: flood risk, the age of the current flood hazard data, population growth trends and potential for growth, recent flood claims, and disaster declaration history. The availability of local data and high-quality ground elevation data is reviewed for use in preparing flood hazard data. The CNMS database is reviewed to identify large areas of unknown or unverified data for streams. FEMA consults the State of Louisiana CTP, the State NFIP Coordinator, and the State Hazard Mitigation Office when watersheds are identified for study.

Flood Risk

Numerous flooding events are listed in the historical record. The release of water from Toledo Bend Reservoir in 2016 amounted to 207,000 cubic feet per second (cfs) of water being discharged into the Sabine River and caused flooding of the structures downstream. In August 2017, Hurricane Harvey forced officials to open the Toledo Bend Dam gates to draw down the water level as a precaution. Once Hurricane Harvey moved over the Toledo Bend Reservoir, the water level continued to rise, forcing officials to open 11 gates along with having two generators running and discharging 36,390 cfs of floodwater into the Sabine River.

Growth Potential

The Toledo Bend Reservoir watershed land use is predominately forests. Most of the towns, villages, and the city within the watershed are lightly to moderately developed. Based on a steady decline in population over the past 10 years, future development is likely to happen gradually over time.

Age of Current Flood Information

Caddo Parish and DeSoto Parish have been updated to modernized parish-wide DFIRMs and FIS reports as part of FEMA's Map Modernization (MAP MOD) program that began in 2004. Some studies went effective as recently as 2015. However, many of the hydrology and hydraulic models supporting the mapping currently shown on the FIRMs in these parishes have not been updated since the 1990s or early 2000s. All the mapping shown on these FIRMs were mixed between Zones X, AE, and A floodplains and did not always show readily available Base Flood Elevations (BFEs). Sabine Parish does not have DFIRMs.

The combination of related severe floods and outdated flood information indicate that this watershed needs updated flood hazard information to support floodplain management activities.

Availability of High-Quality Ground Elevation Data

FEMA's data availability review indicated that high-quality ground elevation data was available for all of the Toledo Bend Reservoir watershed in the form of Light Detection and Ranging (LiDAR) data. This data provides a great basis for preparing hydrologic and hydraulic modeling and help identify development and earth-moving activities near the streams and creeks. The available LiDAR data was collected by LSU, FEMA, and NRCS between 2008 and 2019. The source and date of the LiDAR topographic data coverage used in the Discovery and BLE projects for in the Toledo Bend Reservoir watershed is shown in Figure 5. See Figure 9 in Appendix I for topographic data sources for the whole watershed.

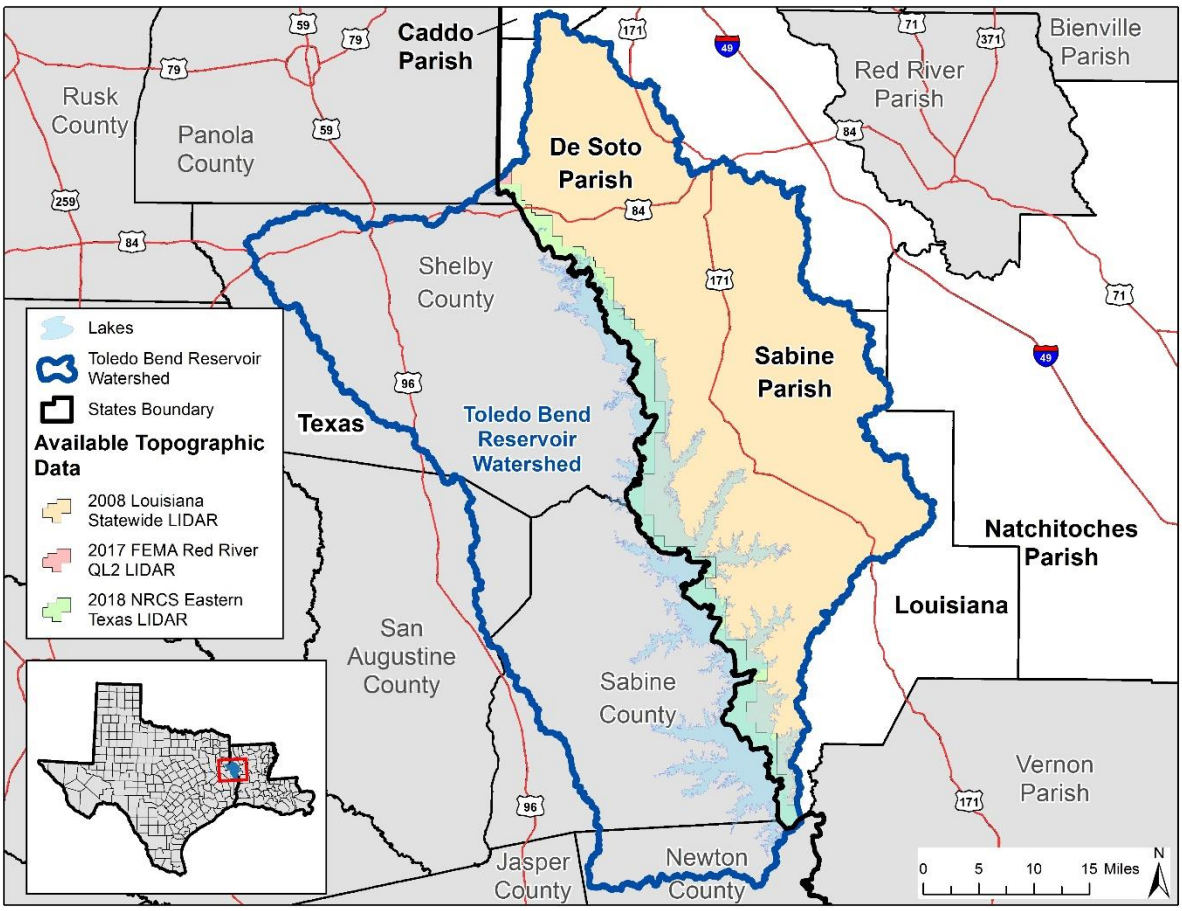


Figure 5: Availability of LiDAR data

Coordinated Needs Management Strategy (CNMS) Database Review

The CNMS database indicates the validity of FEMA's flood hazard inventory. CNMS reviews 17 criteria to determine whether flood hazard information shown on the current FIRMs is still valid. Streams that are indicated as ***Unverified*** or ***Unknown*** in the database indicate that the information used to map the floodplains currently shown on the FIRM is inaccessible or that a complete evaluation of the critical and secondary CNMS elements could not be performed. Figure 6 shows the CNMS-based attributed streams for the study area.

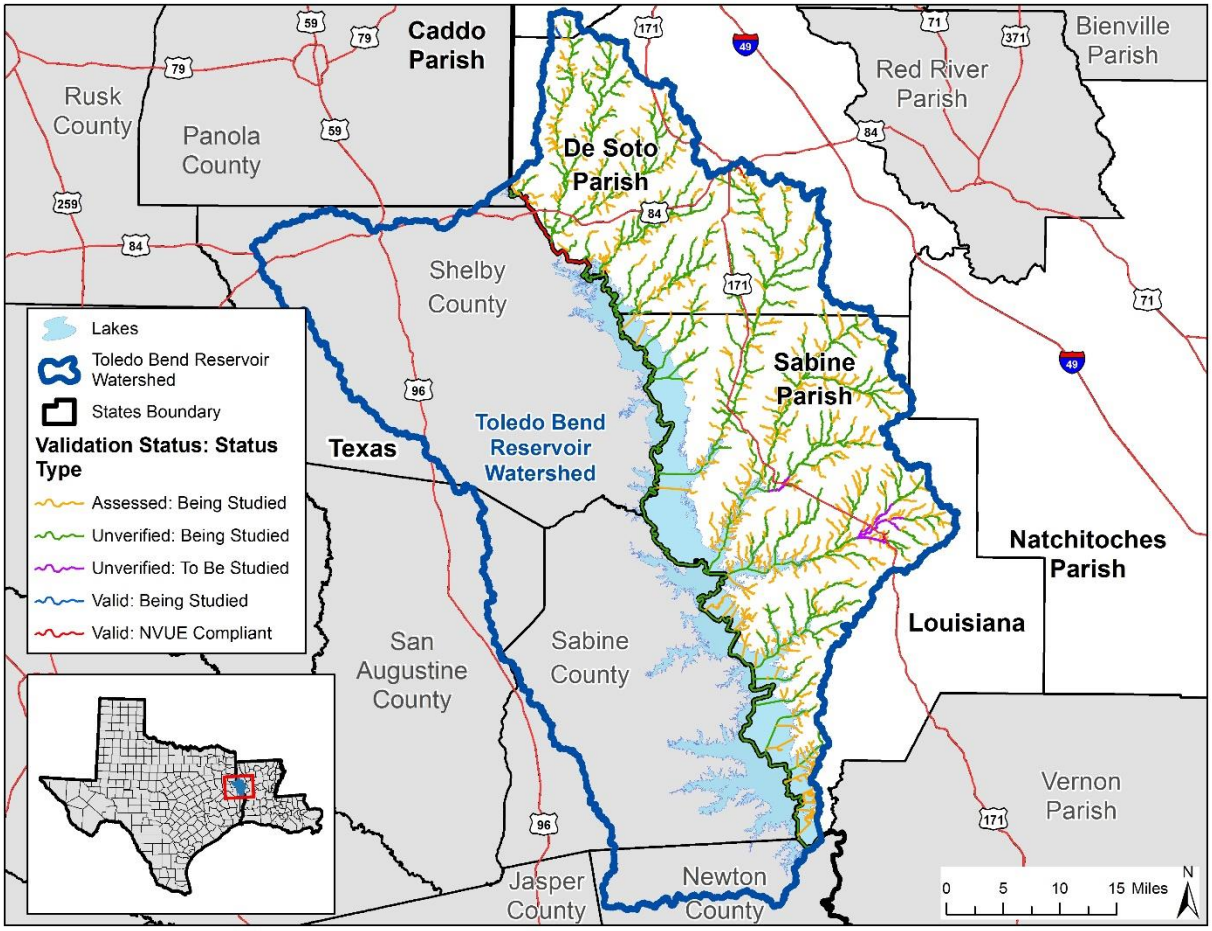


Figure 6: Overview of CNMS streams

Unmapped Stream Coverage

FEMA also reviewed the current stream coverage and reviewed the areas against the National Hydrography Dataset (NHD). The NHD medium-resolution data inventoried by the USGS maps created at a 1:100,000 scale was used to review the watercourses within the Toledo Bend Reservoir watershed. Population centers of 1,000 or more were reviewed for additional mileage against the high-resolution data inventoried by the USGS Quadrangle maps created at a 1:24,000 scale. CNMS was completed as part of the BLE project in November 2020 and was updated as part of the Discovery process. The intent of this review was to identify streams and watercourses and create a complete stream network for preparing BLE data.

Phase Zero – Base Level Engineering (BLE) – Toledo Bend Reservoir Watershed (2019)

In 2019, FEMA began investing in BLE data development for the Toledo Bend Reservoir watershed on the Texas and Louisiana state lines. This 2D approach prepares multi-profile hydrologic (how much water) and hydraulic (how is water conveyed in existing drainage) data for a large stream network or river basin to generate floodplain and other flood risk information for the basin area. BLE utilizes a gridded surface and precipitation model in conjunction with breaklines at significant hydraulic features and structures (streams, roads, dams, etc.) to develop a pluvial flooding model that is calibrated to reflect data collected with USGS stream gages. The BLE project was published in November 2020 as MIP case number 20-06-0051S for Toledo Bend Reservoir watershed. The BLE report is included in Appendix III.

BLE provided an opportunity for FEMA to produce and provide non-regulatory flood risk information for a large watershed area in a much shorter time. The data prepared through BLE provided planning-level data that is prepared to meet FEMA's Standards for Floodplain Mapping. BLE is scalable and can be updated for use as regulatory and non-regulatory products. Communities can choose to adopt the BLE as approximate, model-backed mapping in locations without model-backed Zone A mapping. Detailed studies can add structures to the BLE modeling for further refinement into Limited Detail studies or Detailed studies with or without floodway. shows the network of streams analyzed using the BLE approach. The results of this BLE study have been incorporated into the Discovery process to support the engagement and communication activities that take place during the Discovery phase.

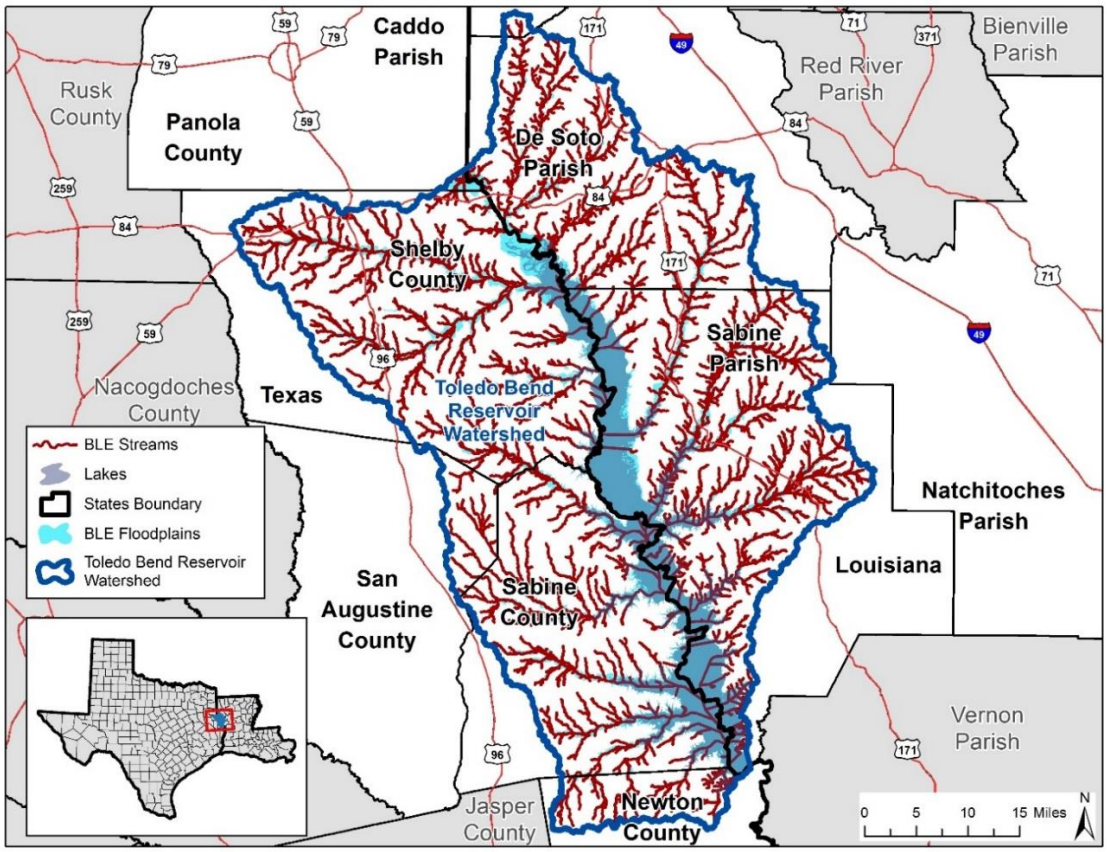


Figure 7: Overview of BLE streams and BLE floodplain

FEMA Base Level Engineering (BLE) Deliverables
The BLE provided the following items for use in the Toledo Bend Reservoir watershed:

- Hydrologic modeling (regression) flow values for the 10%, 4%, 2%, 1%, 1%+ and 0.2%, and 1%- frequencies
- Hydraulic (HEC-RAS) modeling for all study streams (for the same frequencies listed above)
- 10-, 1-, and 0.2-percent-annual-chance floodplain boundaries
- 1- and 0.2-percent-annual-chance Water Surface Elevation Grids
- 1- and 0.2-percent-annual-chance Flood Depth Grids
- HAZUS flood analysis for the watershed
- Point file indicating the location of culverts and inline structures that may be informed by local as-built information
- Flood Risk Map (See Appendix I)

The BLE information is available on FEMA's Estimated BFE viewer for communities to use in planning, risk communication, floodplain management and permitting activities.

CNMS Validation and Assessment
Per the Toledo Ben Reservoir BLE Report, "[as] described in Title 42 of the Code of Federal Regulations, Chapter III, Section 4101(e), once every five years, FEMA must evaluate whether the information on Flood Insurance Rate Maps (FIRMs) reflects the current risks in flood prone areas. FEMA makes this determination of flood hazard data validity by examining flood study attributes and change characteristics, as specified in the Validation Checklist of the Coordinated Needs Management Strategy (CNMS) Technical Reference. The CNMS Validation Checklist provides a series of critical and secondary checks to determine the validity of flood hazard areas studied by detailed methods (e.g., Zone AE, AH, or AO)."

The Regional CNMS database, National Flood Hazard Layer, and paper inventory was used as reference data to ensure extent of the BLE results represents appropriate flooding extent. The BLE CNMS were revised for the study watershed during Discovery and the report tables are available in Appendix I.

Phase One – Discovery: Toledo Bend Reservoir Watershed

The LADOTD-led Discovery project focused on the "Discovery" of flood hazards and risks throughout the Toledo Bend Reservoir watershed. Through the Discovery process, flood risks are identified and local communities have an opportunity to collaborate with the State CTP to identify specific regions within the watershed that may benefit from future FEMA funded studies and assessments. Discovery initiates open lines of communication and relies on local involvement for productive discussions about flood risk. The process provides a forum for a watershed-wide effort to understand the interrelationships between upstream and downstream community flood risk throughout the watershed. At the conclusion of the Discovery process, the identified needs of the watershed will be considered for future investment in the Risk MAP process.

The Toledo Bend Reservoir watershed Discovery project was completed through the following activities:

- Data Gathering
- Pre-Discovery Engagement Efforts
- Discovery Meeting
- Watershed Findings and Prioritizations

All possible efforts were made to ensure that stakeholders understood Discovery and the Risk MAP process through emails, phone calls, newsletters, and a developed website created for this Discovery project.

Data Gathering

Federal and state databases were downloaded and reviewed during the Pre-Discovery phase to highlight areas of concern where additional information from stakeholders would be most beneficial to fully understand the flood risk and damages in the area. Dams, levees, soils classification, recent developments, various population metrics, collections of high-water marks and low water crossings, historical flooding information, and more were reviewed to best prepare for in-depth conversations surrounding local action and impact. Additionally, the BLE water surface elevation rasters were compared to the effective flood extents and base flood elevations to check for any differences that might have been the result of changes in terrain or modeling considerations used in the non-regulatory model development. The final BLE Report is available in Appendix III. Table 4 summarizes the geospatial data collected.

Table 4: Geospatial Data Collection

Data Type	Data Source	Data Description
HUC Watershed Boundaries	USGS	HUC boundary for the Toledo Bend Reservoir HUC-8. Also includes HUC-10 and HUC-12.
Roadways	US Census Bureau	2021 TIGER Line Roads
Jurisdictional Boundaries - Louisiana	LADOTD	Data includes city and parish boundaries
Jurisdictional Boundaries - Texas	Texas Natural Resources Information System (TNRIS)	Data includes city and county boundaries
Current Effective Floodplain Information	FEMA DFIRMs	Data includes Floodplains, BFEs, and Cross Sections
Stream Lines	FEMA DFIRMs	Stream Centerlines and Profile Baselines from DFIRM
BLE Floodplains and Stream	FEMA	Base Level Engineering Study for the Toledo Bend Reservoir Watershed
Locations of Letters of Map Revision (LOMRs)	FEMA	LOMRs incorporated into Effective DFIRM databases and LOMRs filed after Effective DFIRM dates for watershed parishes
Coordinated Needs Management Strategy	FEMA	CNMS database dated December 31, 2021
Topography - Louisiana	LADOTD	2007 & 2008 Statewide LiDAR
Topography - Texas	FEMA, NRCS	2016 FEMA Naches Basin QL2 LiDAR
		2017 FEMA Red River QL2 LiDAR
		2018 NRCS Eastern Texas LiDAR
HAZUS-based Loss Estimates	FEMA	HAZUS 5.0 (2021) building exposure and flood lost estimates per Census Tract
Location of Dams	National Inventory of Dams	Dam locations with Emergency Action Plan (EAP) status
Stream Gauges	USGS	Stream Gauge locations
Flood Claims	FEMA NFIP	Total number and value of claims by community for Louisiana
Land Cover	USGS	National Land Cover Dataset for 2011 and 2019
Land Use	USGS	Derived from National Land Cover Dataset 2019
Population	US Census Bureau	2020 U.S. Census
Population Growth	US Census Bureau	Calculated change between the 2010 and 2020 U.S. Census
U.S. Congressional Districts - Louisiana	LADOTD	Congressional District Boundaries
State House & Senate Districts - Louisiana	LADOTD	State House and Senate District Boundaries
U.S. Congressional Districts - Texas	TXDOT	Congressional District Boundaries
State House & Senate Districts - Texas	TXDOT	State House and Senate District Boundaries
National Risk Index	FEMA	NRI Rating data at the census tract level

The Discovery engagement process also included the development of a user-friendly website for data collection, verification, and coordination. The website was developed to become a repository to collect project information such as community background data; newsletters; planned meeting dates, times, and locations; project data deliverables; and reports. Figure 8 and Figure 9 show the website splash screen and progress tracking page, respectively.

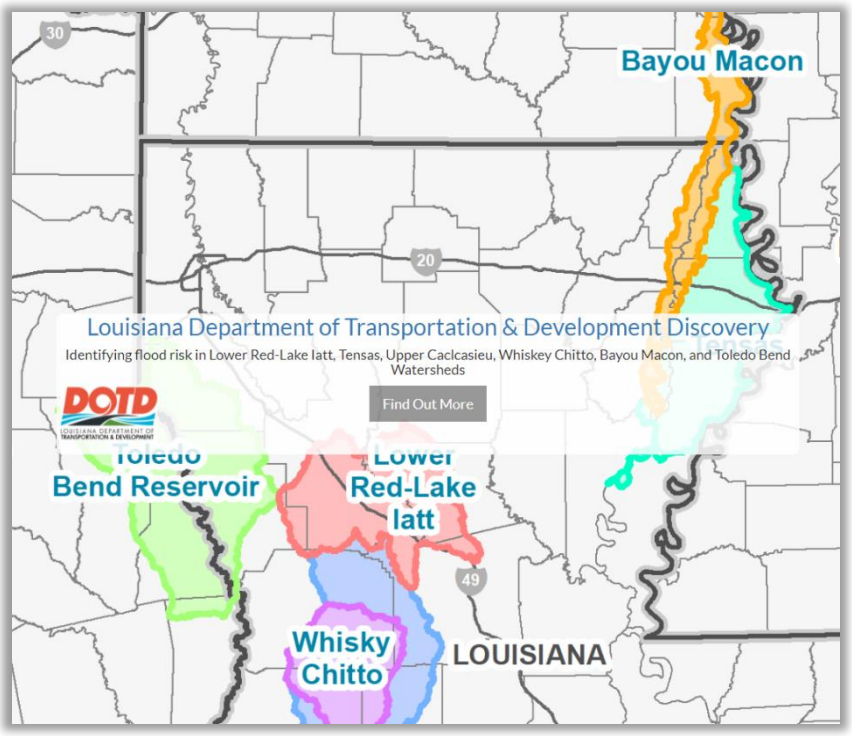


Figure 8: Website Splash Screen

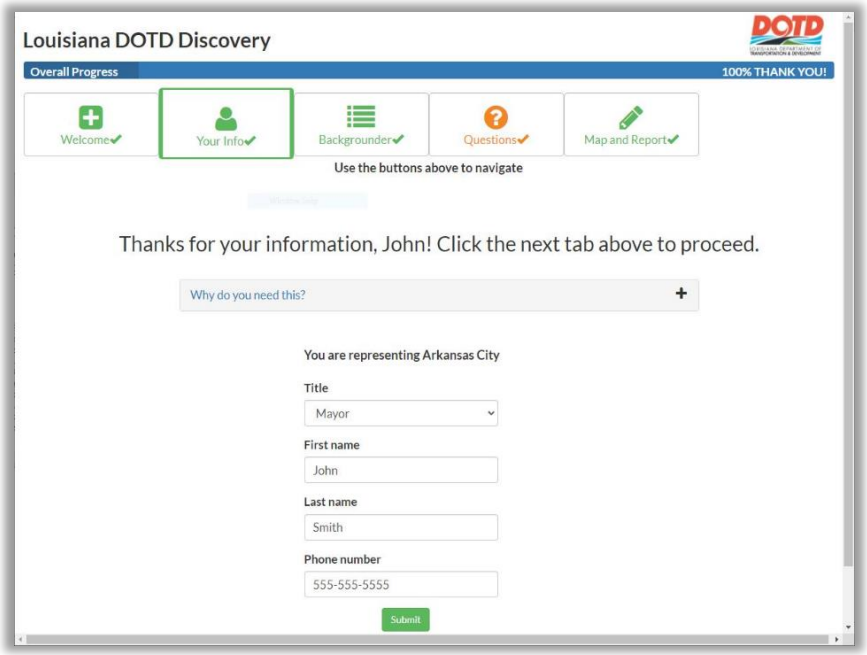


Figure 9: Website Progress Tracking Page

For the FEMA LADOTD Discovery project, the Discovery website allowed participating stakeholders to view basemap layers pertinent to the study area, including BLE rasters and polygons, effective FIRM layers, and satellite and street view imagery. Users were then able to update flood-related information about their community, including local flood risks, flood hazards, mitigation plans, mitigation activities, flooding history, development plans, and floodplain management activities. It also allowed stakeholders to input Areas of Mitigation Interest (AOMI) such as mitigation concerns, mapping needs, and requests on a web map. The website tracked community participation and helped accelerate the Discovery process by creating easy-to-use GIS shapefiles with attribute tables relevant to flood sources and community comments. Figure *10* shows the webmap interface.

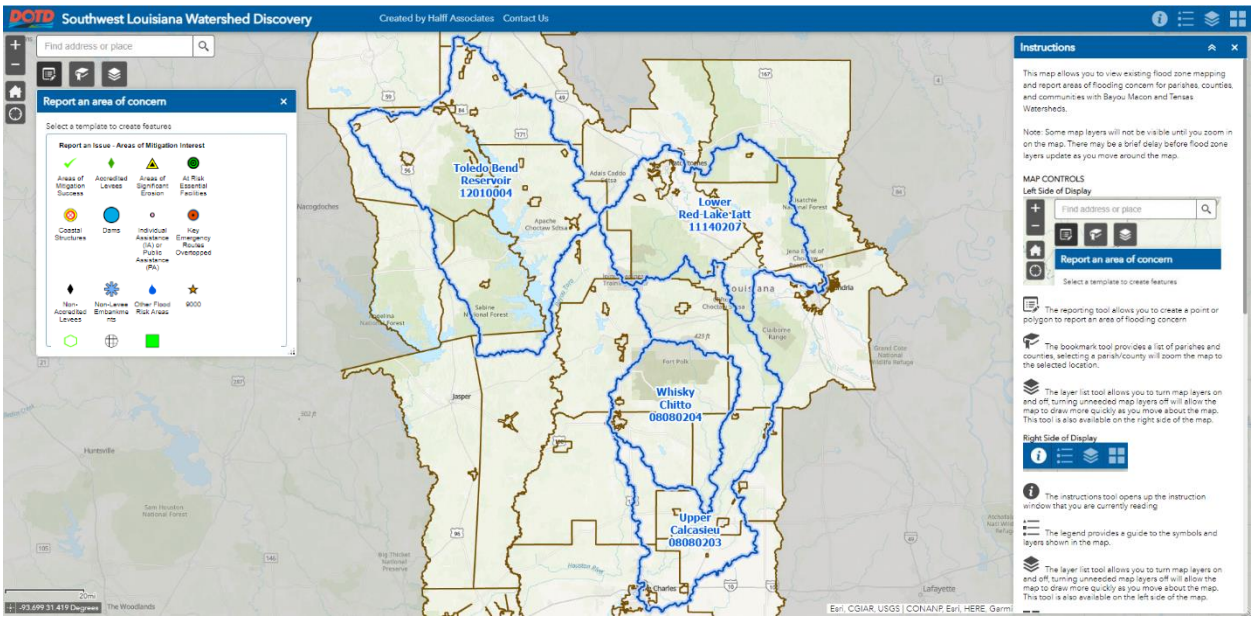


Figure 10: Webmap Interface

Pre-Discovery Engagement Efforts

A Discovery flyer was emailed out to the communities on file two weeks prior to the Pre-Discovery Meeting. A Discovery newsletter was also developed and distributed to all stakeholders to gain public awareness of the Toledo Bend Reservoir Discovery process. The newsletter contained information about FEMA's Risk MAP program, the Discovery process, details of the upcoming Pre-Discovery Meeting, the data collection process, and the Risk MAP process beyond Discovery. A copy of the flyer and newsletter is included in Appendix I.

LADOTD held a virtual informational Pre-Discovery Meeting on January 19, 2022, for stakeholders in the study watershed. A copy of the presentation is available in Appendix I. The Pre-Discovery informational meeting was held to increase awareness of the Discovery process prior to the Discovery Meeting so that the stakeholders would be prepared to fully participate in the Discovery process. Seven stakeholders participated in the meeting. The goals of the Pre-Discovery Meeting were to:

- Explain the Discovery process
- Explain why LADOTD was conducting Discovery in the Toledo Bend Reservoir watershed
- Explain FEMA's Risk MAP program and benefits
- Introduce the website with a tutorial and open website enrollment
- To obtain information for Discovery in the watershed

Discovery Meeting

An in-person Discovery Meeting was held in the watershed area with the goals of gathering additional flood risk data, discussing the communities' flooding history, development plans, flood mapping needs, and flood risk concerns, and discussing the vision for the watershed's future and the importance of mitigation planning and community outreach. The Discovery Meeting occurred on March 9, 2022, from 12 pm - 4 pm in Many, Louisiana, at the Cypress Bend Golf Resort, Spa and Conference Center. In addition, an in-person Discovery Meeting was held in the Red River-Lake Iatt watershed on March 8, 2022 from 12:00 pm - 4:00 pm at the Natchitoches Parish Library in Natchitoches Parish, Louisiana, and an in-person Discovery Meeting was held for the Whisky Chitto and Upper Calcasieu watersheds on March 10th at the Beauregard Parish Library from 12:00 pm - 4:00 pm in DeRidder, Louisiana. Local stakeholders were invited to join for any of these meetings to offer flexibility in schedules and ideally collect more data.

Community stakeholders were able to participate in the meeting when most convenient to them. Discovery Ambassadors assisted stakeholder attendees through various stations in an "come and go" format. The stations included:

- *Laptops* – stakeholders were able to review, edit, or add information entered on the Discovery website.
- *Discovery Maps* – Data collection process to capture information on identifying flood risk locations and problems, areas of growth or planned development, answering floodplain questions, and identifying map need locations.

Following the Discovery Meeting, stakeholders were contacted through email and phone calls to discuss their concerns and comments in detail. Often, in-person meetings were scheduled to offer a more in-depth webmap training and fuller conversations surrounding the identified areas of mitigation interest. Through these efforts, 100% community participation and representation were achieved via either phone/email coordination, in person meetings, or webmap usage.

The Toledo Bend Reservoir Discovery project gathered 14 comments from the Discovery Meeting from phone calls, and from the online webmap. Of these 14 comments, there were four new mapping requests.

Watershed Findings and Project Prioritizations

Watershed Findings

Following the Discovery Meeting, the gathered community comments were placed into categories by comment type and summarized by parish, as shown in .

Table 5: Toledo Bend Reservoir Comment Distribution by Parish

Parish/County Names	Stakeholder Comments						Total Number of Comments
	Mapping Request	Dams	General Flood Note	Streamflow Constrictions	Flooding Hot Spot	Other (As Reported)	
Caddo, LA	No Comments Received						0
DeSoto, LA			1				1
Natchitoches, LA	No Comments Received						0
Sabine, LA	4	2	2	3	2		13

*Some comments were general to watershed naming, do not provide flooding or pertinent information, or are conversations had and are not represented in this table

Figure 11 shows a sample of the comments submitted by communities. There were four mapping request comments requesting a more detailed study in the area. There were two comments regarding dam age and releases. There were three stream constriction comments, two general flood notes, and two flooding hot spot comments as well. All stakeholder comments were submitted to FEMA in the digital supplemental data deliverable associated with this project.

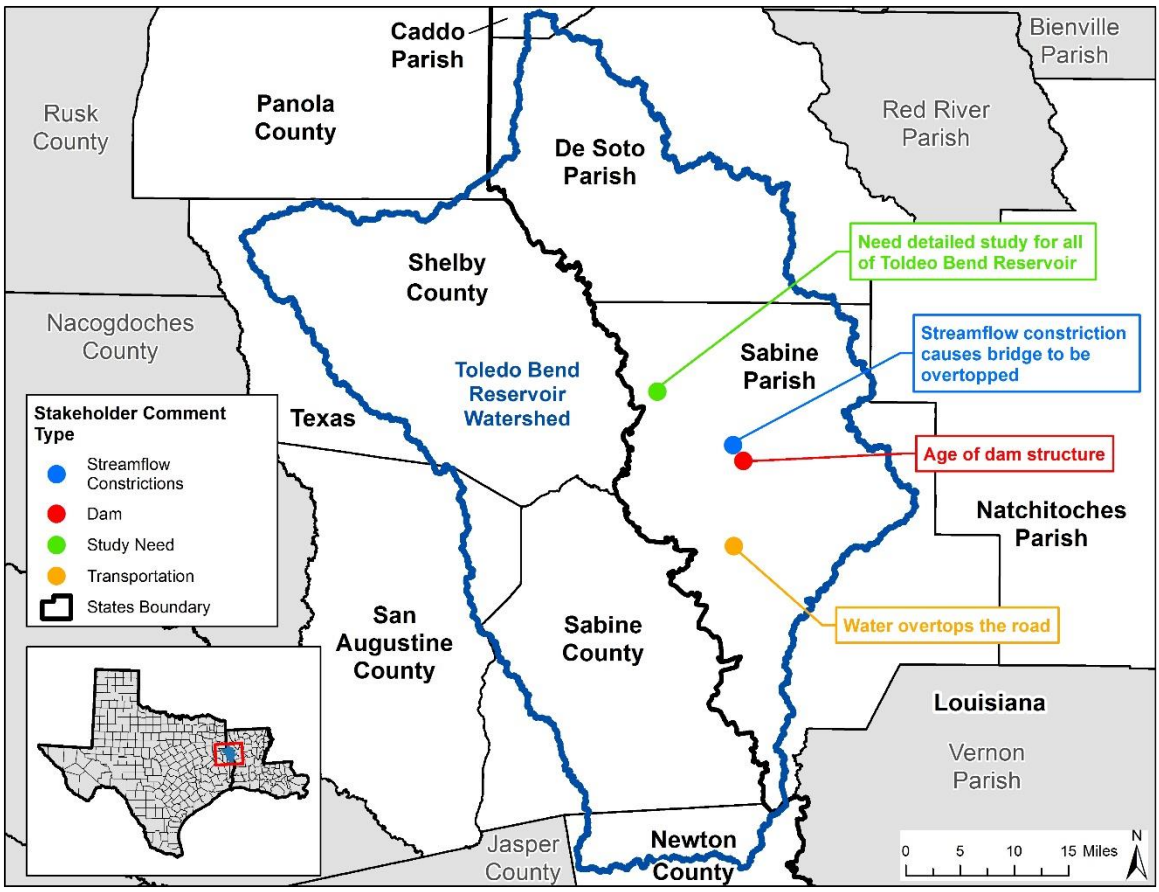


Figure 11: Stakeholder Comment Examples

Figure 12: Stakeholder Comment Totals demonstrates the differences in numbers per comment type. Fourteen comments were submitted for studies needed because of flooding risks, such as homes flooding due to dam releases, age of dams, and streamflow constrictions. Mapping concerns include four comments related to needs for updated mapping, such as older effective maps which do not match the current drainage patterns.

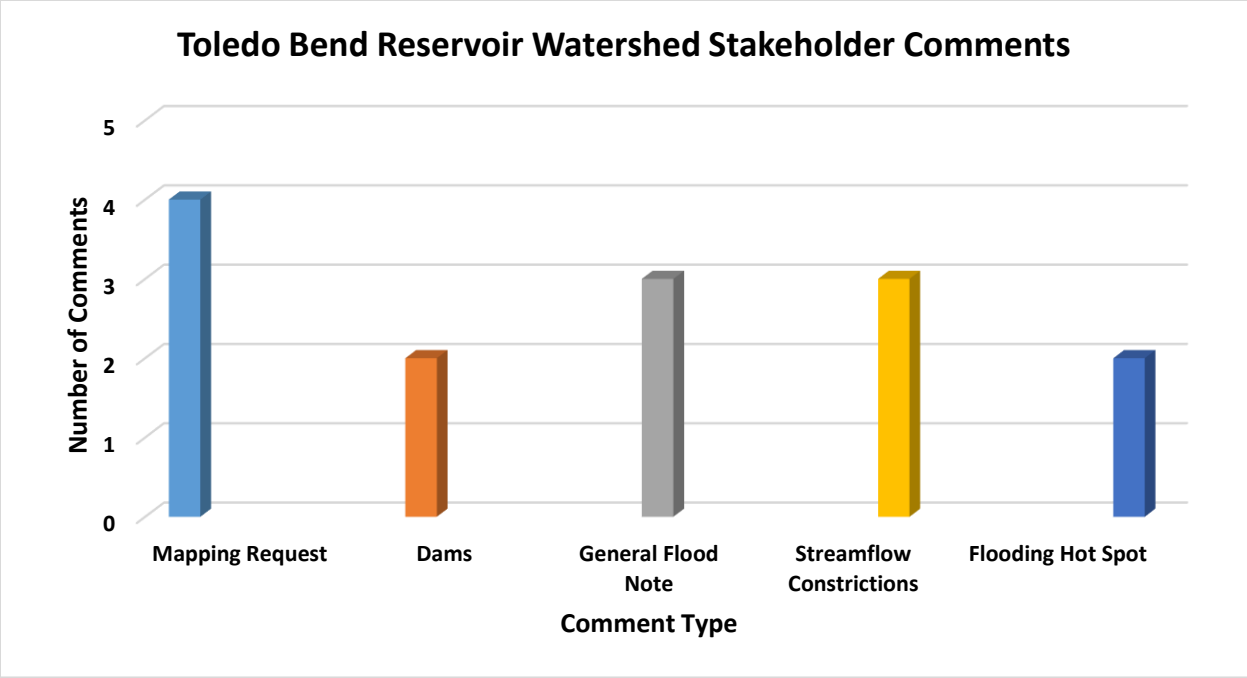


Figure 12: Stakeholder Comment Totals

Project Selection and Prioritization

Because of the presence of approximately 830 unverified CNMS stream miles in either Zone A or AE in the rural communities of this HUC - 8 watershed, it is recommended that mapping updates be performed at a parish-wide level, rather than at the level of the individual flooding sources. This recommended mapping change would bring the number of modernized parishes from three to four (Sabine Parish is not yet modernized). Table 6 gives a more in-depth review of the parish CNMS data for all four parishes that intersect the Toledo Bend Reservoir watershed.

Table 6: CNMS Data by Parish

CNMS Data by Parish							
Parish	Total Area (mi^2)	Oldest Effective FIRM Date	Total Stream Miles	Total Streams Unverified			A/AE Unverified of Total Mileage
				Zone	Segment Count	Miles	
Caddo	940	5/19/2014	1,346	A	15	220	30%
				AE	18	186	
DeSoto	1,773	12/16/2003	892	A	158	627	71%
				AE	3	9	
Natchitoches	1,269	7/6/2015	2,244	A	344	883	44%
				AE	16	105	
Sabine	1,009	8/5/1991	1,260	A	200	709	58%
				AE	8	28	

Using the age of the oldest effective FIRM in the parish in conjunction with the percentage of unverified CNMS stream mileage, these parishes' needs were prioritized from a low to moderate to high ranking with Sabine Parish rated as the highest priority. In addition to the CNMS data listed above, additional information such as partial update coverage and dates, DFIRM status, and stakeholder comments and requests were considered for this ranking. The outcome of this exercise can be seen in Table 7.

Table 7: Mapping Needs Prioritization by Parish

Mapping Needs Prioritization by Parish		
Parish	**Priority**	**Reason**
Sabine	Highest	More than 55% of the stream miles are unverified, and the oldest effective date exceeds the last 30 years. No DFIRM.
Natchitoches	High	More than 40% of the stream miles are unverified, but the oldest effective date is within the last 10 years. DFIRM available.
DeSoto	Moderate	More than 70% of the stream miles are unverified, but the oldest effective date is within the last 20 years. DFIRM available.
Caddo	Moderate	More than 30% of the stream miles are unverified, but the oldest effective date is within the last 10 years. DFIRM available.

Caddo Parish has FIRMs dating back to 2014, and about 30% of stream miles are unverified Zone A or AE streams. Though the parish has the lowest needs ranking in the watershed, these considerations still suggest this parish should be ranked as "Moderate." Also receiving a "Moderate" ranking is DeSoto Parish. Mapping updates were last made in 2003, leaving over 70% of stream miles as unverified Zone A or AE streams. The areas of this parish intersecting the Toledo Bend Reservoir watershed do have lower HAZUS loss risks than represented by other parishes, so the ranking has maintained as only "Moderate." Although Natchitoches Parish is comparable to Caddo Parish when considering age of oldest FIRM and percentage of CNMS mileage that is unverified Zone A or AE, this parish receives a "High" rank due to having nearly 1,000 unverified stream miles in the parish. Additionally, several comments were made in high population areas in the parish but just outside the boundary of the Toledo Bend Reservoir watershed. The lack of DFIRM availability, oldest FIRM dates in the watershed (dating back to 1991), and nearly 60% of CNMS mileage being unverified Zone A or AE all support Sabine Parish in receiving the "Highest" ranking for CNMS needs prioritization. A heatmap outlining the parishes' ranks and unverified CNMS Zone A and AE streams can be seen in Figure 13.

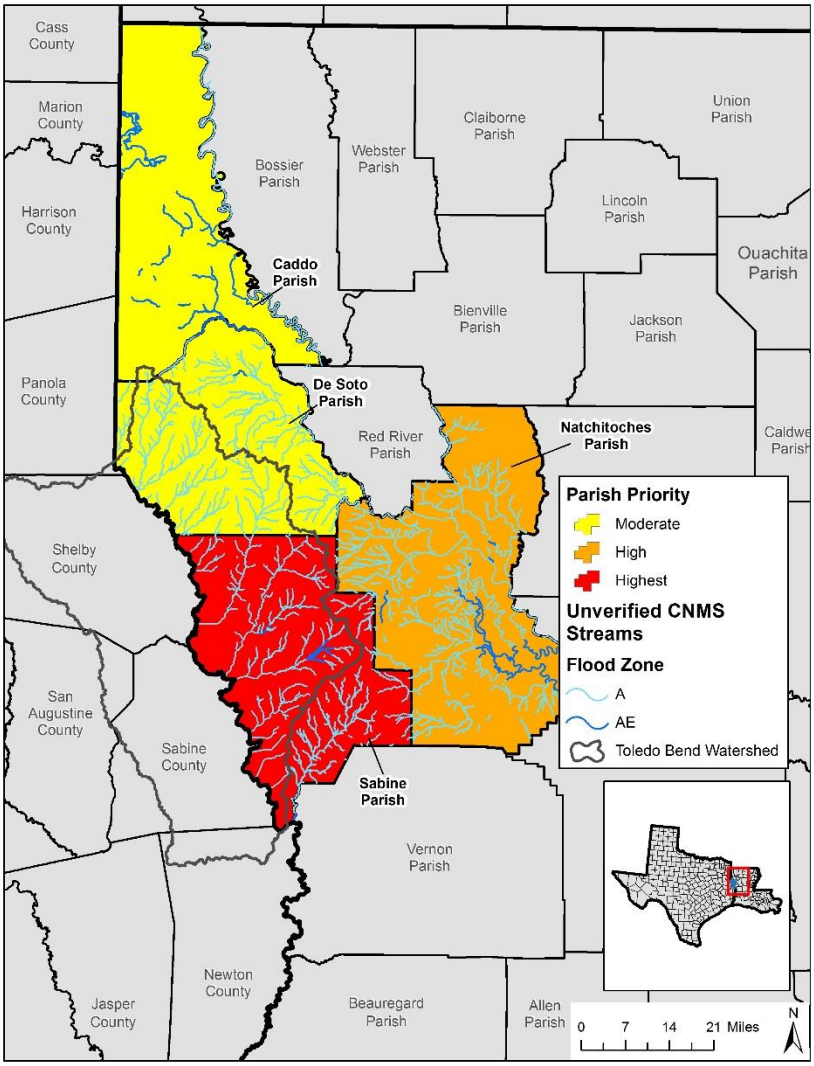


Figure 13: Parish Prioritization with Unverified CNMS Zone A and AE Streams

When considering these projects, effort and cost associated with that effort must be weighed. The bulk of stream miles in need of update for all four of these parishes fall under Zone A. Given the BLE availability and recent practices of adopting BLE for FIRM map creation, it is expected that these miles will incur a reduced cost from previous Zone A modeling and mapping tasks. Every parish has unverified Zone AE streams as well. These will require enhancement of the BLE models with structure survey and further refinement before being used for any FIRM production.

Data availability for enhancement and limiting factors, such as lack of levee accreditation, must also be weighed when considering parishes for updates and modernization. For parishes with non-accredited levee systems, further discussions on the status and schedule of accreditation should happen before the investment in the enhancement of BLE. Table 8 and Table 9 outline the data availability and limitations as described.

*Table 8: Parish Levee Accreditation Status**

Parish	Modernized	Levee Accreditation	
		Levee	Accreditation
Caddo	Y	Black Bayou-Pine Island	Non-Accredited
		Caddo North LA	Accredited
		Caddo South LA	Accredited
		Red River-West Agurs	Accredited
		River East Bank-South Levee System (Bossier)	Provisionally Accredited
		Twelve Mile Bayou	Accredited
DeSoto	Y	-	-
Natchitoches	Y	Caddo South LA	Accredited
		Campti-Clarence AR	Accredited
		Martco Levee	Accredited
		Natchitoches LA	Accredited
		Natchitoches West Bank Levee System	Non-Accredited
		Natchitoches-Red River West Bank Levee 2	Accredited
		Red River-Kraft System	Accredited
		State of Louisiana-Red River Levee 2	Accredited
Sabine	N	-	-

*Includes all levees in the parishes affected by the watershed

Table 9: Parish BLE Status

Parish	Additional Intersecting BLE Models		
	Watershed Name	Status	Level of Study
Caddo	Bayou Pierre	Published	2D
	Caddo Lake	In Progress	-
	Cross Bayou	In Progress	-
	McKinney-Posten Bayous	In Progress	-
	Middle Red-Coushatta	Published	2D
	Middle Sabine	Published	1D
DeSoto	Bayou Pierre	Published	2D
	Middle Sabine	Published	1D
Natchitoches	Bayou Pierre	Published	2D
	Black Lake Bayou	Published	2D
	Lower Red-Lake Iatt	Published	2D
	Middle Red-Coushatta	Published	2D
	Saline Bayou	Published	2D
	Upper Calcasieu	Published	2D
Sabine	Bayou Pierre	Published	2D
	Lower Red-Lake Iatt	Published	2D
	Lower Sabine	Published	1D

Flood Risk Assessments Results

HAZUS is a risk assessment software program for analyzing potential losses in dollars from floods, hurricane winds, and earthquakes. The BLE flood data developed for this project was used as input data for the HAZUS-based flood risk assessment. The Toledo Bend Reservoir watershed has an estimated $6 billion dollars worth of vulnerable assets, including residential, commercial, and other asset types. If a 100-year storm event were to occur throughout the watershed, HAZUS estimated three percent of the assets will be damaged, with losses estimated at nearly $125 million dollars to physical assets. There will also be economic losses, including lost wages, inventory losses, losses in production, and economic opportunity losses, valued at $90 million dollars. Figure 15 and Figure 14 show the capital stock inventory within the study watershed and the corresponding 100-year event losses. Figure 11 in Appendix I shows a more detailed potential loss risk map for the watershed.

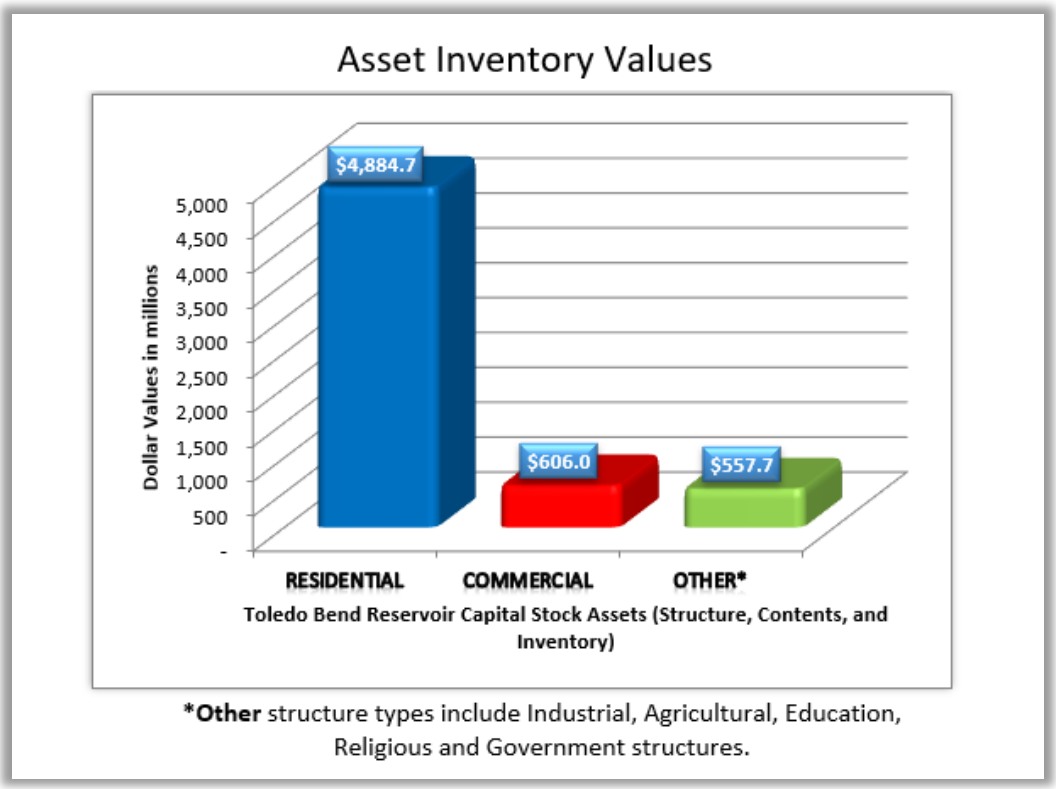


Figure 15: Asset Inventory Value Totals

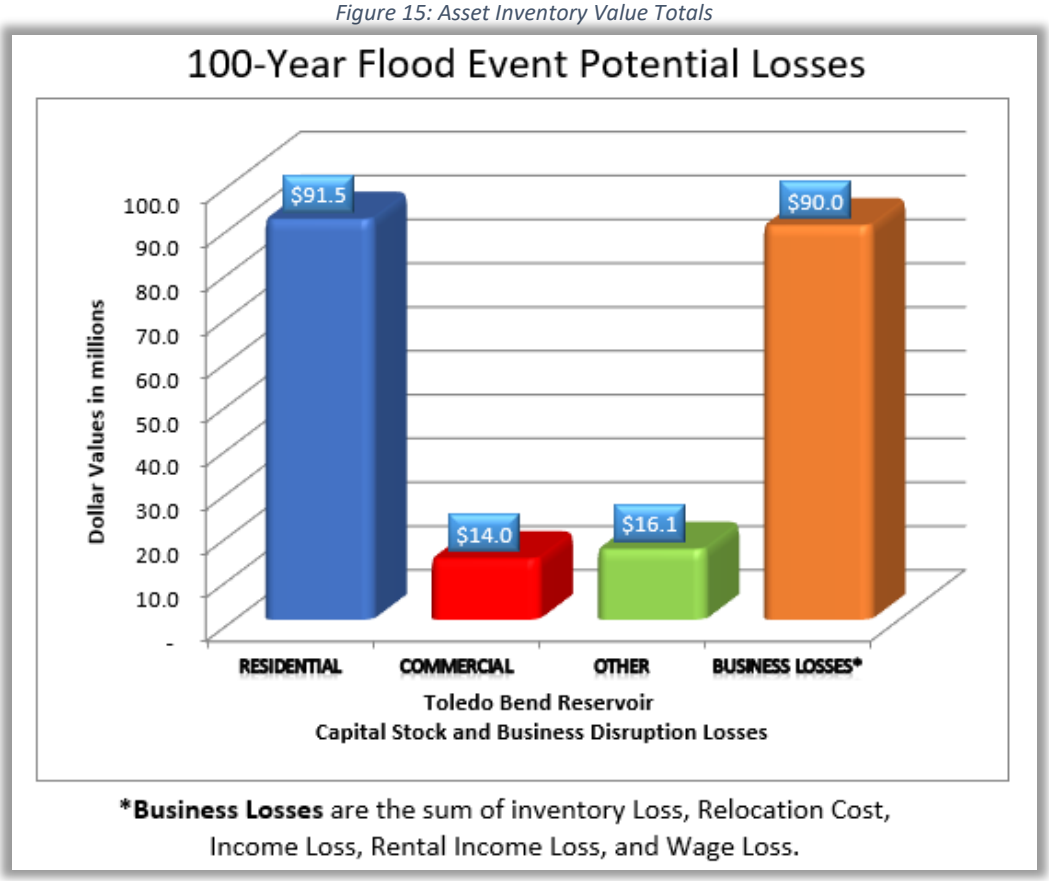


Figure 14: 100-Year Flood Event Potential Loss Totals

Because the parishes in the Toledo Bend watershed have land in other watersheds, these HAZUS-based 100-year flood loss estimates are not indicative of their total potential loss estimates. Hence, the losses shown in this report do not necessarily represent community-wide totals.

Aggregating the HAZUS-based 100-year flood loss estimates to parishes provides another method to prioritize new studies and hazard mitigation projects in the watershed. Figure 16 ranks the HUC-12s by estimated flood losses. Most of the watershed is at risk for $1 million dollars to $27 million dollars in potential loss if there is a 100-year flood event. Fourteen HUC-12s risk up to $1 million dollars in potential loss.

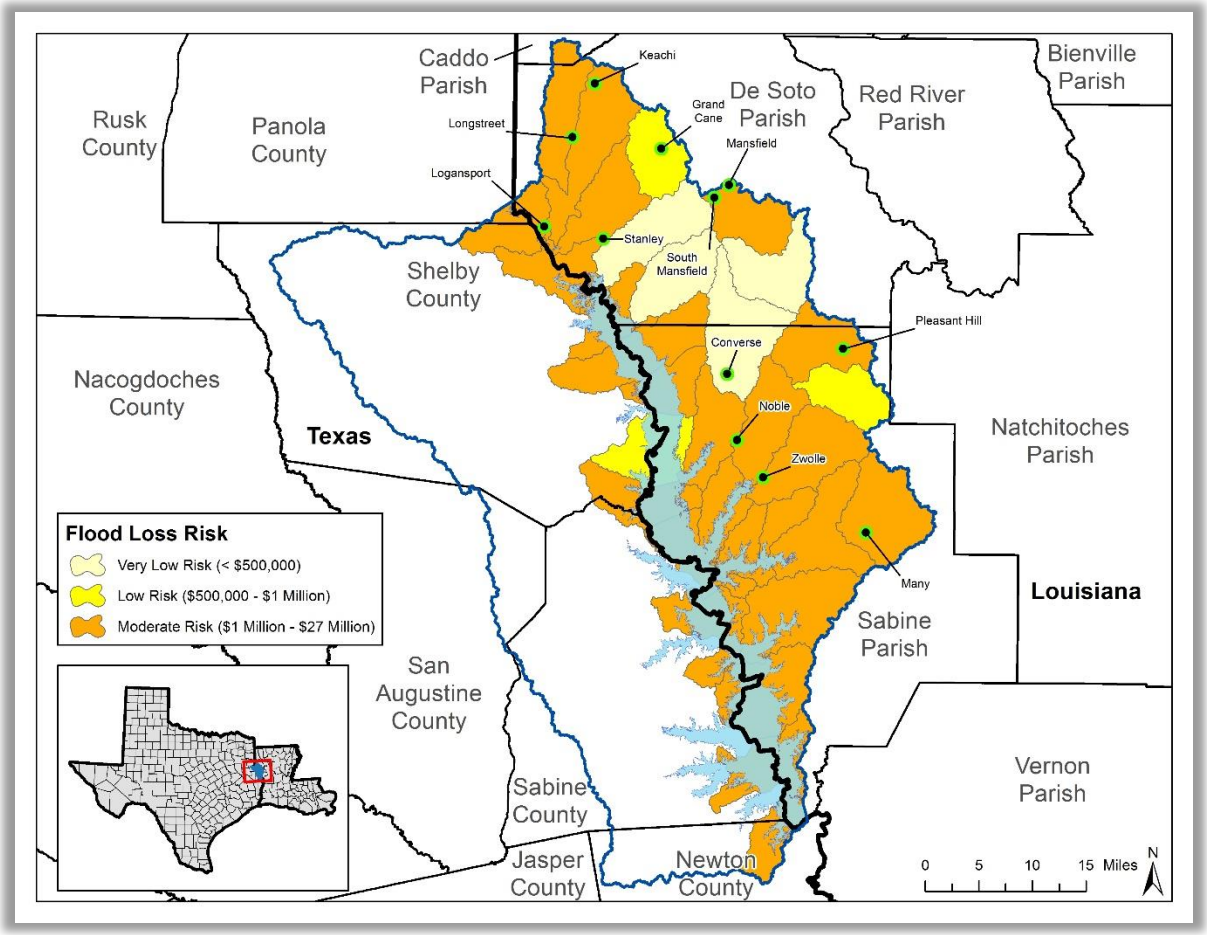


Figure 16: HAZUS-based 1% Annual Chance Loss Estimates by HUC-12s

Project Recommendation

Based on the needs of the communities, the availability of the data, and the current FEMA investment process, the proposed projects were prioritized for FEMA investment based on the following criteria. First, non-digital parishes with no levees are recommended as primary considerations for immediate investment. The projects would enhance the BLE data in areas with effective Zone AE streams and advance BLE data to FIRMs. The next tier is the non-digital parishes with Accredited levees. These projects would enhance and advance BLE while incorporating the results of the levee accreditation. The next tier is the non-digital parishes with non-accredited levees. These projects require additional coordination with the

levee owners to determine accreditation status and schedule before BLE enhancement and advancement can occur. The readiness of the community to provide support is also considered in project prioritization.

From the outlined criteria for consideration and available data for reference, the following projects are recommended.

- **Sabine Parish BLE Enhancement and Regulatory Update** – Sabine Parish is non-digital with 720 miles of a combination of model-backed and non-model-backed effective Zone A and 34 miles of Zone AE streams. The study would leverage the Lower Red–Lake Iatt, Lower Sabine, Bayou Pierre, and Toledo Bend Reservoir BLE datasets for all Zone A streams and enhance the 34 miles through the effective Zone AE. The enhanced data would be combined with the BLE data to update the parish regulatory data. The Parish Social Vulnerability Index Score is 0.8396.
- **Natchitoches Parish BLE Enhancement and Regulatory Update** – Natchitoches Parish FIRMs are digital and were updated in 2015. There are 1,147 miles of a combination of model-backed and non-model-backed effective Zone A and 122 miles of Zone AE streams in the parish. The study would leverage the seven BLE datasets that cover the parish and enhance the 122 miles through the effective Zone AE. The enhanced data would be combined with the BLE data to update the parish regulatory data. Prior to funding the study, the levee accreditation status of the eight levees in the parish would be confirmed. If there are any proposed changes to the accreditation status, then the levee information would be confirmed prior to initiating the regulatory process. The Parish Social Vulnerability Index Score is 0.838.
- **DeSoto Parish BLE Enhancement and Regulatory Update** – DeSoto Parish FIRMs are digital and were updated in 2003. There are 635 miles of a combination of model-backed and non-model-backed effective Zone A and 24 miles of Zone AE streams in the parish. The study would leverage the Bayou Pierre, Middle Sabine, and Toledo Bend Reservoir BLE datasets that cover the parish and enhance the 24 miles through the effective Zone AE. The enhanced data would be combined with the BLE data to update the parish regulatory data. The Parish Social Vulnerability Index Score is 0.8469.
- **Caddo Parish BLE Enhancement and Regulatory Update** – Caddo Parish FIRMs are digital and were updated in 2014. There are 873 miles of a combination of model-backed and non-model-backed effective Zone A and 409 miles of Zone AE streams (with an additional 22 miles in Zone AH) in the parish. The study would leverage the seven BLE datasets that cover the parish and enhance the 431 miles through the effective Zones AE and AH. The enhanced data would be combined with the BLE data to update the parish regulatory data. Prior to funding the study, the levee accreditation status of the six levees in the parish would be confirmed. If there are any proposed changes to the accreditation status, then the levee information would be confirmed prior to initiating the regulatory process. The Parish Social Vulnerability Index Score is 0.9096.

Follow-Up On Phase Project Decisions

The BLE results and the effective DFIRM floodplains were compared to identify any areas of significant change. If the results show large areas of change (expansions and contractions of the floodplain, increases and decreases of the computed BFEs, and increases in expected flow values) FEMA will continue to coordinate with the communities to identify the streams that should be considered for FIRM updates. These updates could be Letter of Map Revisions for small project areas, or a Physical Map Revision for large areas with mapping changes.

To identify other streams for future refinement, community growth patterns and potential growth corridors should be discussed with FEMA. These areas of expected community growth and development may benefit from updated flood hazard information. BLE can be further refined to provide detailed study information for a Flood Risk Identification Study and a FIRM update.

Areas of communities that were developed prior to 1970 (pre-FIRM areas) may include repetitive and severe repetitive loss properties. They may also be areas where re-development is likely to occur. Having updated flood hazard information before re-development and reconstruction activities take place may benefit communities by providing guidance to mitigate future risk.



The Discovery process aims to identify a subset of the BLE stream studies to be updated and included on the FIRMs. Communities may wish to review these possible areas and provide feedback once the BLE data has been received. Local communities can also refine BLE information and submit it through the Letter of Map Revision (LOMR) process to revise the existing flood hazard information and maintain the FIRMs throughout their community.

Post-Discovery Findings Meetings

LADOTD held one virtual Post-Discovery Meeting on March 17, 2023, for stakeholders in the watershed. A copy of the presentation is available in Appendix I.

The Post-Discovery informational webinar was held to discuss the results of the Discovery process and findings, including a review of comments received, preliminary HAZUS results, and BLE data. The FEMA Estimated BFE viewer, which can be used for reporting and downloading data, was presented and demonstrated to community stakeholders. The goals of the Post-Discovery Meeting were to:

- Recap FEMA's Risk MAP program's benefits and the Discovery process
- Discuss comments received by stakeholders
- Explain watershed prioritization and stream study requests
- Review HAZUS results
- Demonstrate the permanent FEMA BFE viewer
- Release a draft report to the communities prior to the release of the final report

Future Investments Decisions

FEMA will work closely with communities to identify additional areas for model refinement and FIRM panel updates. Communities will be provided information and training to support the use of BLE for planning, floodplain management, permitting, and risk communication activities. FEMA will work with communities to review, interpret, and incorporate the BLE information into their daily and future community management and planning activities.

Next Steps

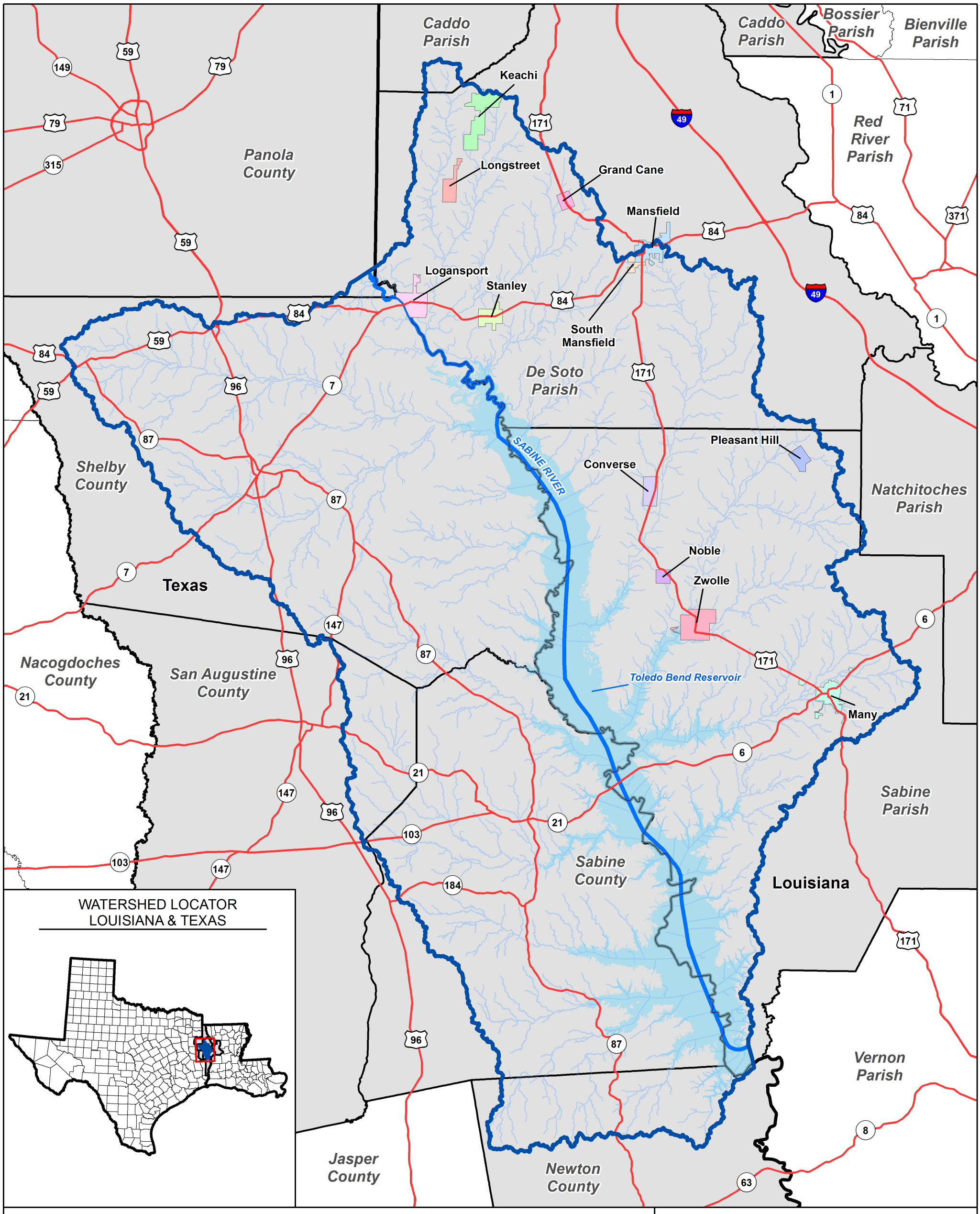
Once the Discovery process is completed, FEMA will review project recommendations and determine if a project will move forward to update the regulatory products (FIS report, FIRM, and DFIRM database). A cursory review of the modeling results indicates that this study area has significant changes in floodplain width and depth.

FEMA will work with communities to collect any outstanding technical inquiries within the study area after delivering the hydrologic and hydraulic analysis and floodplain work maps. After coordinating with communities, FEMA will likely initiate the Phase Three effort to update the regulatory products.

Appendix I: Additional Data

Appendix Figures

Figure 01: Watershed (HUC-8) Location
Figure 02: U.S. Congressional Districts
Figure 03: Louisiana State House Districts
Figure 04: Louisiana State Senate Districts
Figure 05: Population Density
Figure 06: Land Cover
Figure 07: Population Change
Figure 08: Effective Floodplains
Figure 09: Topographic Data Source
Figure 10: NFIP Flood Losses
Figure 11: Flood Risk – Potential Losses
Figure 12: Social Vulnerability Index
Figure 13: Resilience Rating
Figure 14: Flood Risk Rating
Figure 15: Flood Risk Population Exposure
Figure 16: Community Rating System (CRS) Participating Communities



Map Symbology

- Sabine River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Name

- Converse
- Grand Cane
- Keachi
- Logansport
- Longstreet
- Mansfield
- Many
- Noble
- Pleasant Hill
- South Mansfield
- Stanley
- Zwolle

Figure 1:

Watershed (HUC-8) Location

TOLEDO BEND RESERVOIR WATERSHED

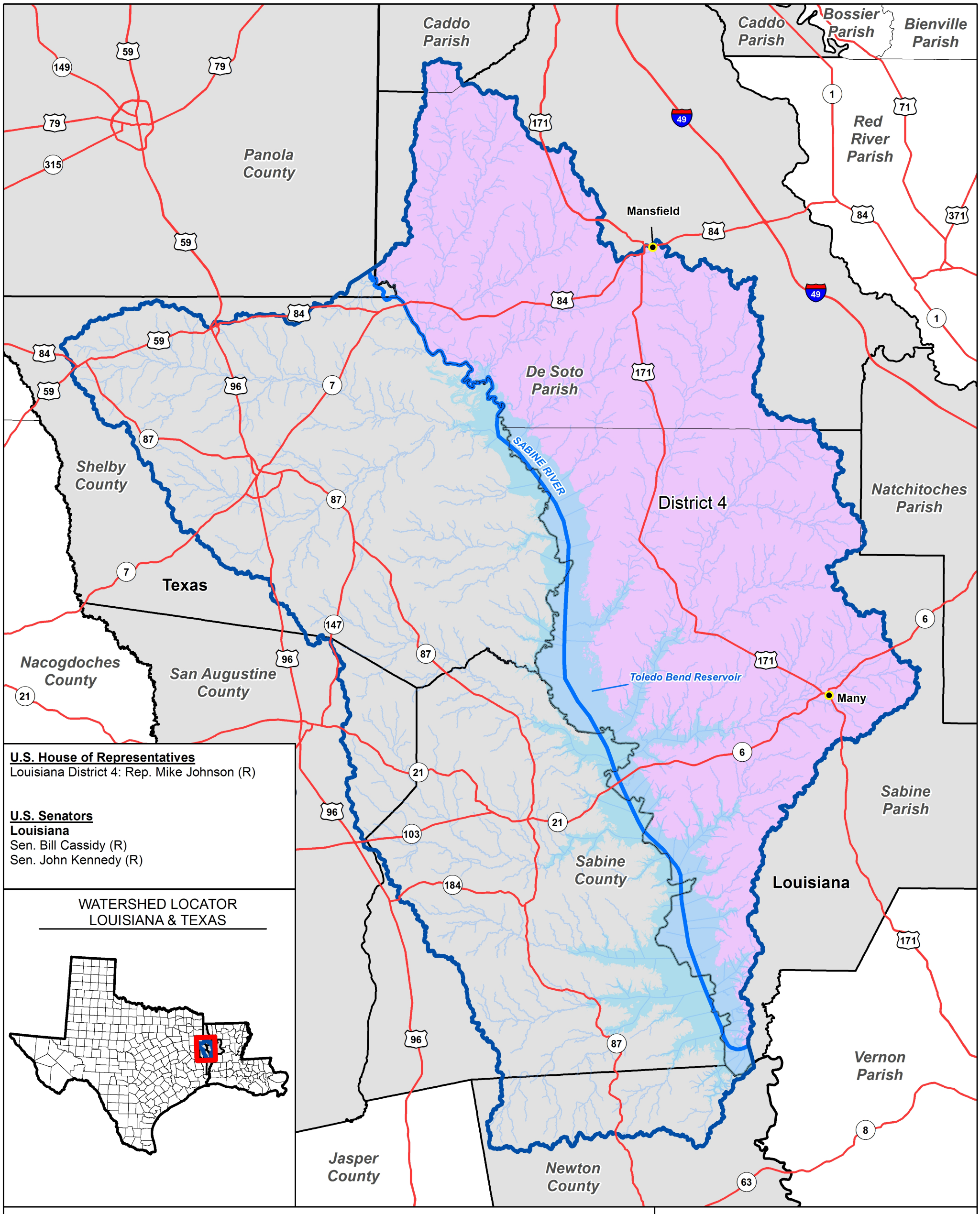
September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N



U.S. House of Representatives
Louisiana District 4: Rep. Mike Johnson (R)

U.S. Senators
Louisiana
Sen. Bill Cassidy (R)
Sen. John Kennedy (R)

WATERSHED LOCATOR
LOUISIANA & TEXAS

Map Symbology

- Parish/County Seat
- Sabine River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

US Congressional Districts (2020)
- 4

Figure 2:

U.S. Congressional Districts

TOLEDO BEND RESERVOIR WATERSHED

September 16, 2022

FEMA

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0 4 8 Miles

N

District 1
District 7
District 23
District 24
Mansfield
Many
Toledo Bend Reservoir
SABINE RIVER
Panola County
Caddo Parish
Bossier Parish
Bienville Parish
Red River Parish
De Soto Parish
Natchitoches Parish
Shelby County
Texas
Nacogdoches County
San Augustine County
Sabine County
Louisiana
Sabine Parish
Vernon Parish
Jasper County
Newton County

Louisiana State House Districts
District 1: Rep. Danny McCormick (R)
District 7: Rep. Lawrence Bagley (R)
District 23: Rep. Kenny Cox (D)
District 24: Rep. Rodney Schammerhorn (R)

WATERSHED LOCATOR
LOUISIANA & TEXAS

Map Symbology

- Parish/County Seat
- Sabine River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Louisiana State House Districts

- House District 1
- House District 7
- House District 23
- House District 24

Figure 3:

State House Districts

TOLEDO BEND RESERVOIR WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

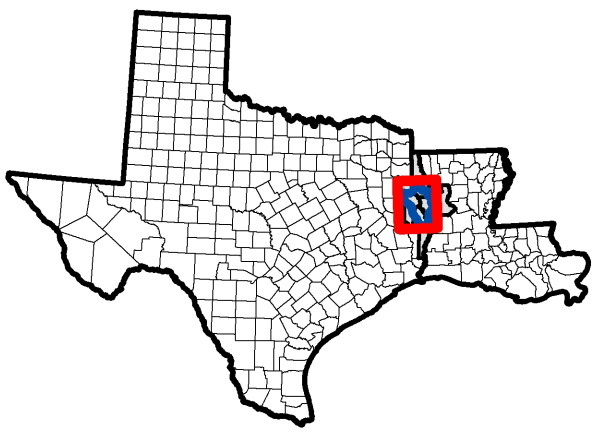
0 4 8 Miles

N

Caddo Parish
Caddo Parish
Bossier Parish
Bienville Parish
Red River Parish
Panola County
Mansfield
District 38
De Soto Parish
SABINE RIVER
Natchitoches Parish
Shelby County
Texas
District 31
Nacogdoches County
San Augustine County
Toledo Bend Reservoir
Many
Sabine Parish
Sabine County
Louisiana
Vernon Parish
Jasper County
Newton County

Louisiana State Senate Districts
District 31: Louie Bernard (R)
District 38: Barry Milligan (R)

WATERSHED LOCATOR
LOUISIANA & TEXAS



Map Symbology

- Parish/County Seat
- Sabine River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Louisiana State Senate Districts
- Senate District 31
- Senate District 38

Figure 4:

State Senate Districts

TOLEDO BEND RESERVOIR WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

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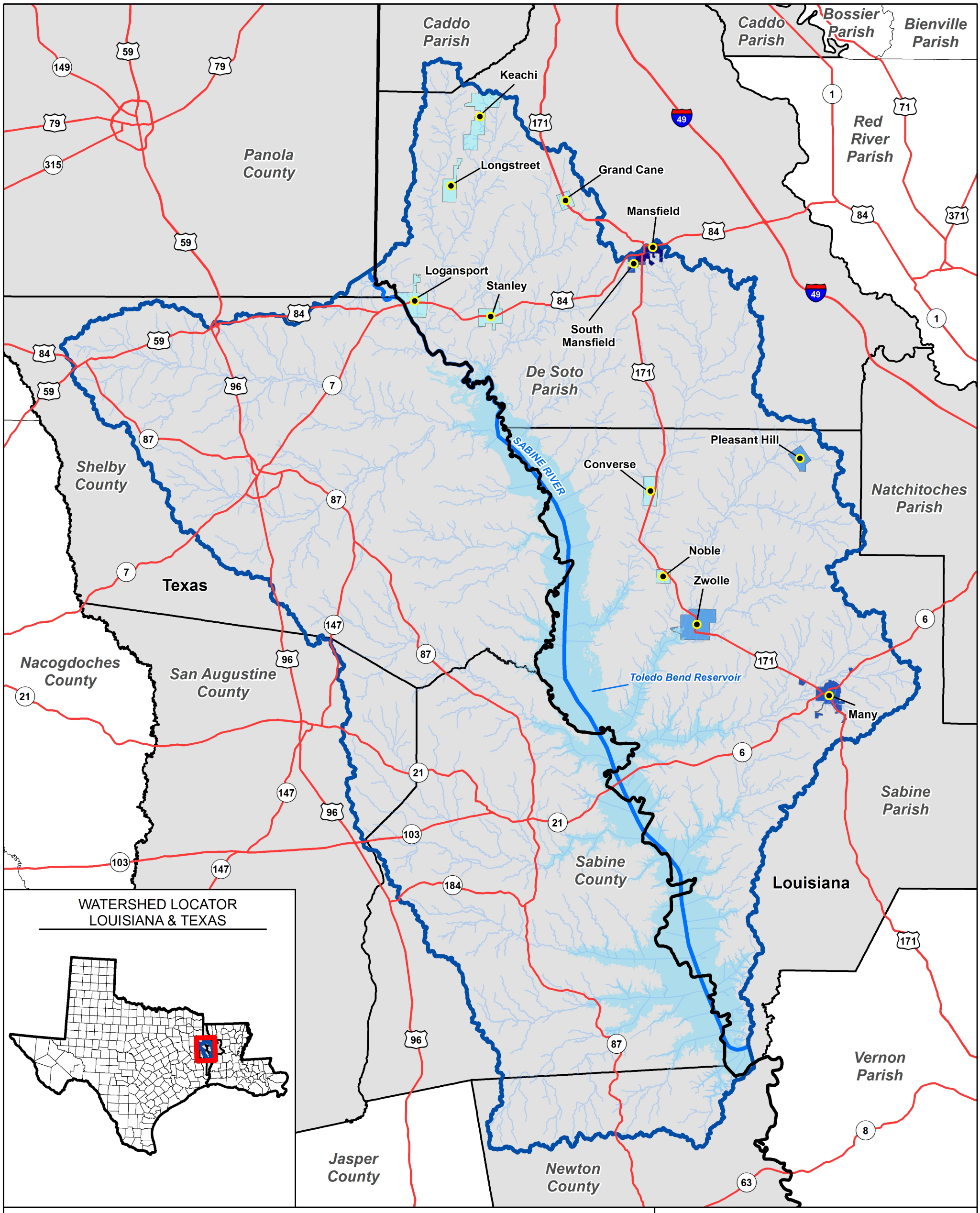

Map Symbology

- Cities
- Sabine River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Population Density (2020*)

- Very Low
- Low
- Medium
- High

* Source: 2020 U.S. Census

Figure 5:

Population Density

TOLEDO BEND RESERVOIR WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

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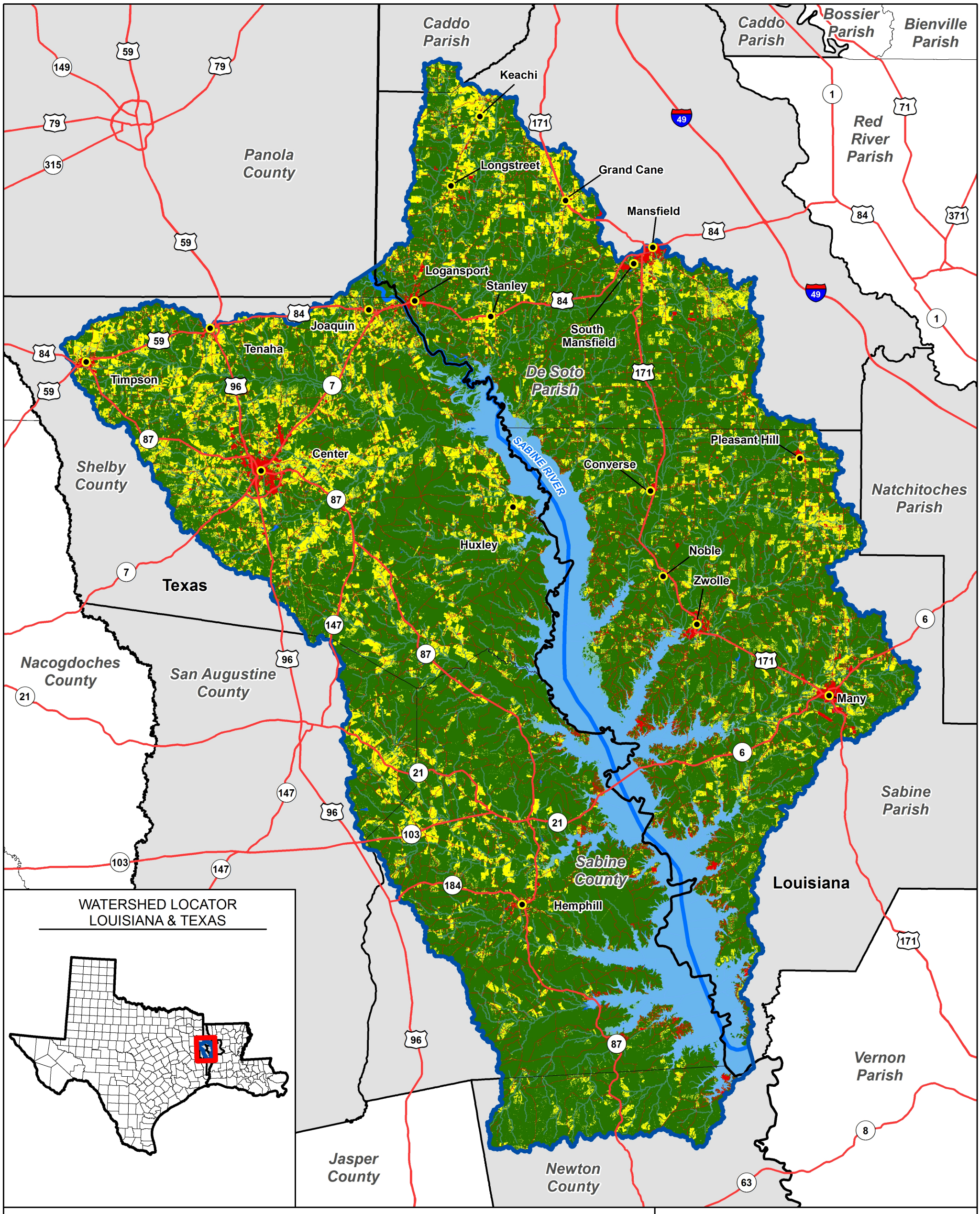


WATERSHED LOCATOR
LOUISIANA & TEXAS

Map Symbology

- Cities
- Sabine River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Land Cover (USDA 2021*)

- Farming
- Forestry
- Open Water
- Urban Development

*United States Department of Agriculture (USDA) Cropland Data Layer

Figure 6:

Land Cover

TOLEDO BEND RESERVOIR WATERSHED

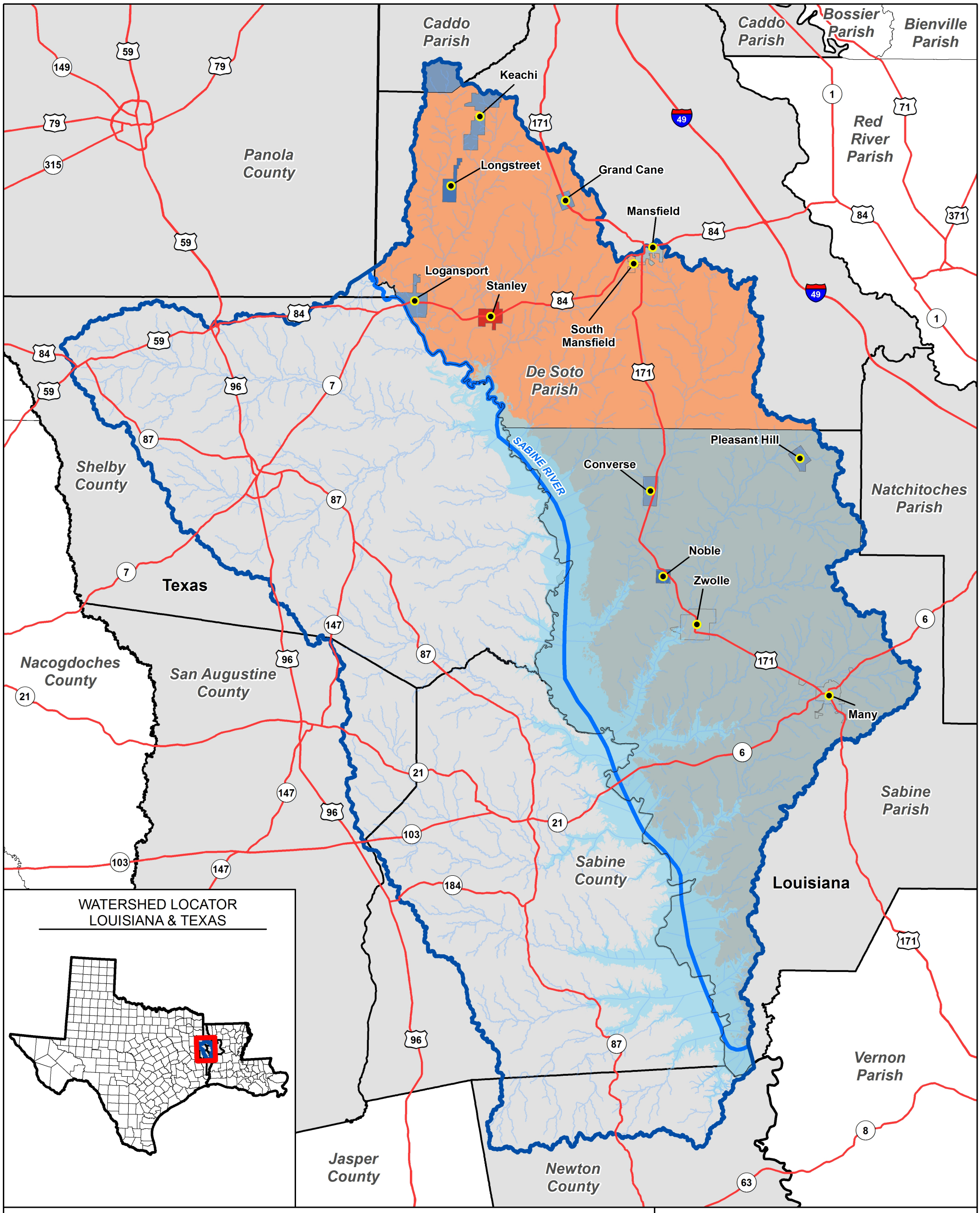
September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N



Map Symbology

- Cities
- Sabine River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Percent Population Change 2010-2020*

- Less than -20%
- -10% to -20%
- -5% to -10%
- 0% to -5%
- No Change
- 0% to 5%
- 5% to 10%
- Greater than 10%

*Source: 2010, 2020 U.S. Census

Figure 7:

Population Change

TOLEDO BEND RESERVOIR WATERSHED

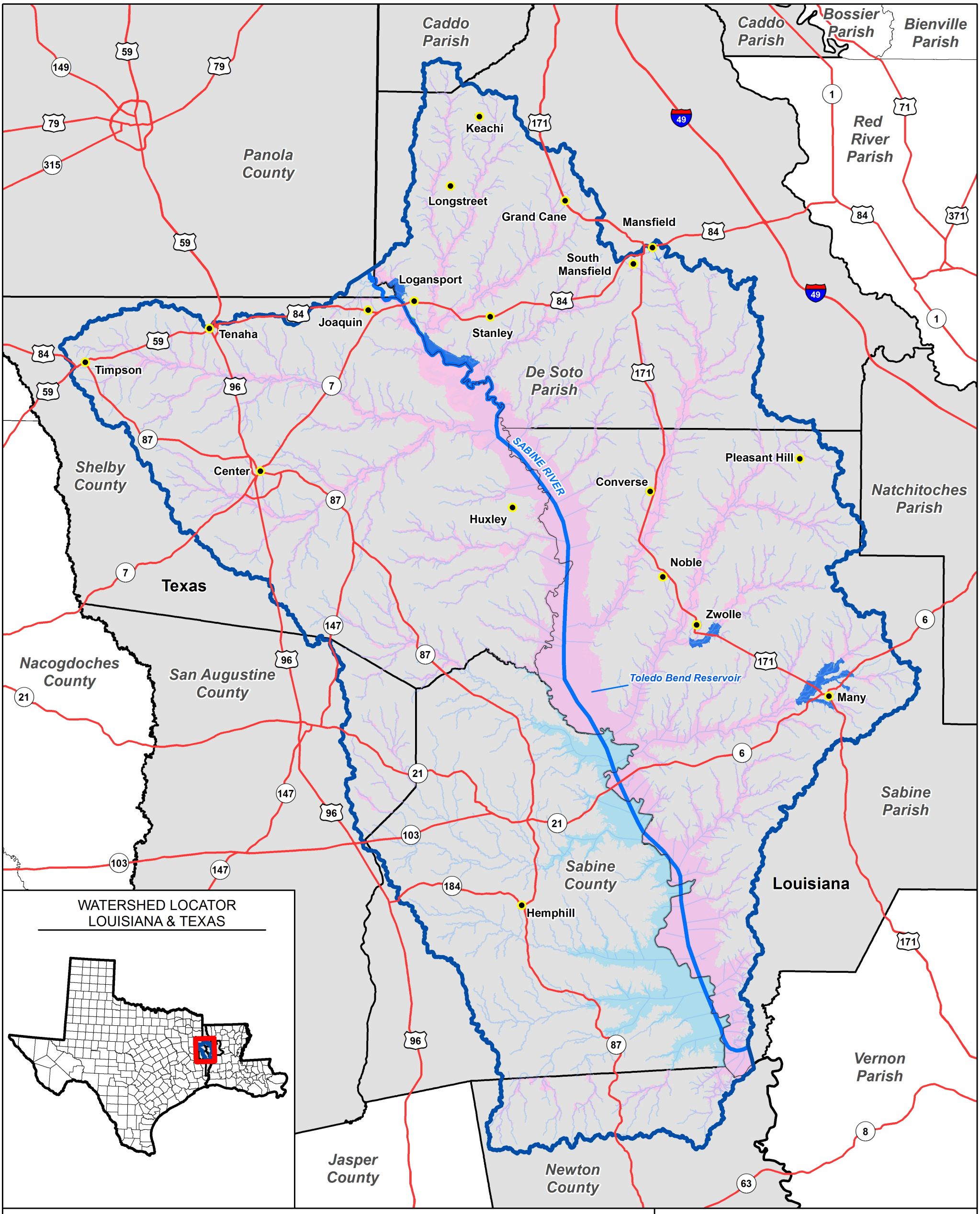
September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N



Map Symbology

- Cities
- Sabine River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Effective FEMA Floodplains (2021)

- Zone AE, AO (100-Year,
- Zone A (100-Year,
- Zone X(500-Year or Depth <1 Foot)

Figure 8:

Effective Floodplains

TOLEDO BEND RESERVOIR WATERSHED

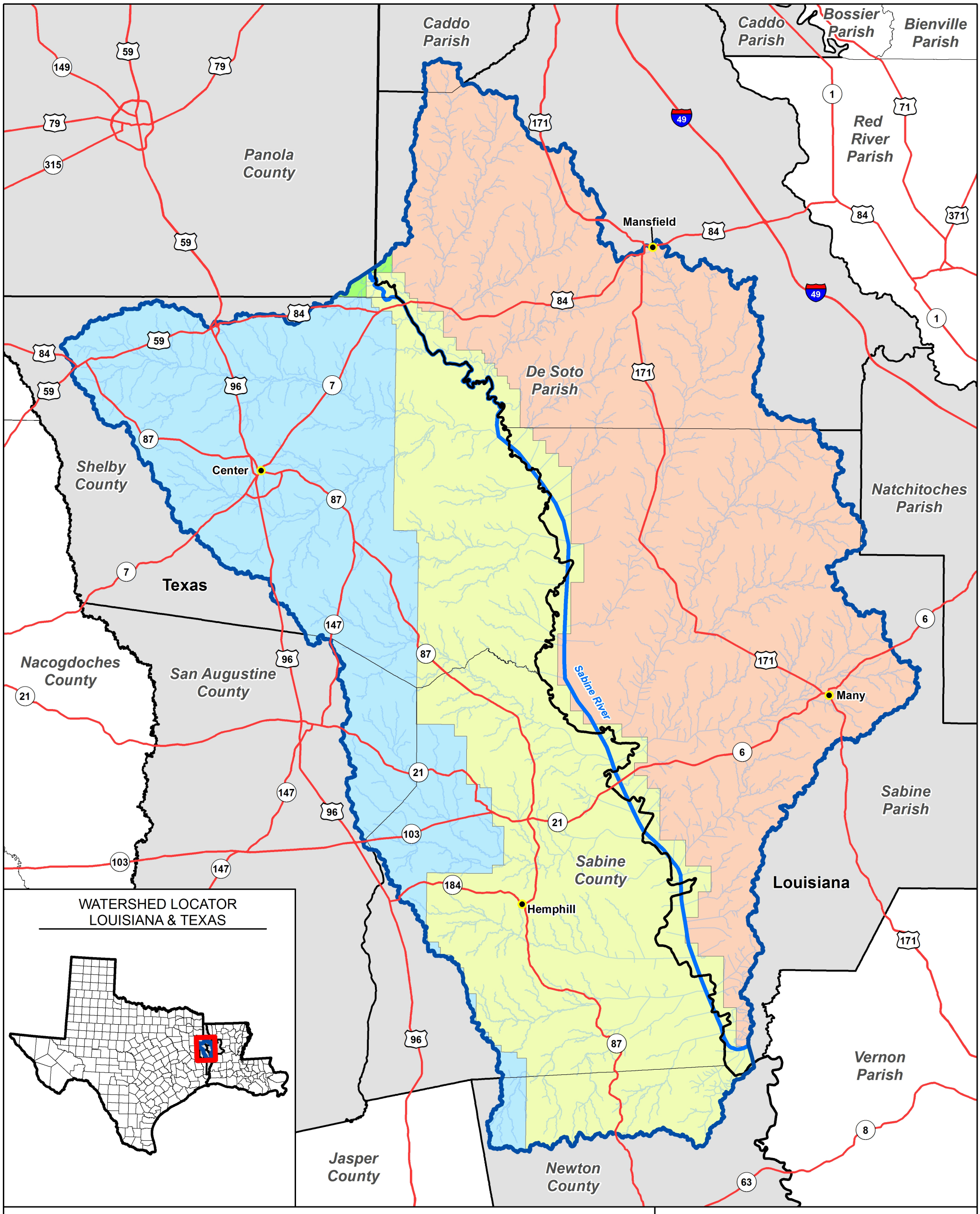
September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N



Map Symbology

- Parish/County Seats
- Sabine River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Available Topographic Data

- 2008 Louisiana Statewide LIDAR
- 2016 FEMA Naches Basin QL2 LIDAR
- 2017 FEMA Red River QL2 LIDAR
- 2018 NRCS Eastern Texas LIDAR

Figure 9:

Topographic Data Source

TOLEDO BEND RESERVOIR WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N

Caddo Parish
Caddo Parish
Bossier Parish
Bienville Parish
Red River Parish
Panola County
Keachi
Longstreet
Grand Cane
Mansfield
Logansport
Stanley
South Mansfield
De Soto Parish
Pleasant Hill
Converse
Noble
Zwolle
Natchitoches Parish
Shelby County
Texas
Nacogdoches County
San Augustine County
Toledo Bend Reservoir
Many
Sabine Parish
Sabine County
Louisiana
Vernon Parish
Jasper County
Newton County
SABINE RIVER
149
59
79
315
171
49
71
1
84
371
96
7
87
147
21
103
184
6
8
63

WATERSHED LOCATOR
LOUISIANA & TEXAS

Map Symbology

- Major Highways
- Watershed Boundary: HUC-8
- Sabine River
- Other Streams
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish Boundary

Community Total NFIP Claims*

- No Data
- 0 to 15
- 16 to 100
- 100 to 433

* Data only includes Louisiana communities

Figure 10:

NFIP Flood Losses

TOLEDO BEND RESERVOIR WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

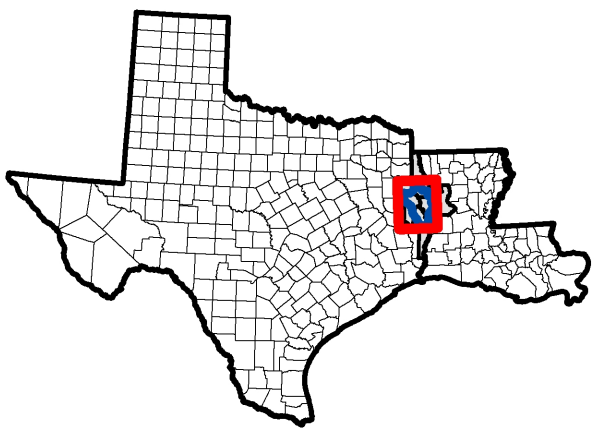
0 4 8 Miles

N

Caddo Parish
Caddo Parish
Bossier Parish
Bienville Parish
Red River Parish
Panola County
Mansfield
De Soto Parish
Shelby County
Center
SABINE RIVER
Natchitoches Parish
Texas
Nacogdoches County
San Augustine County
Toledo Bend Reservoir
Many
Sabine Parish
Sabine County
Louisiana
Hemphill
Vernon Parish
Jasper County
Newton County

149 59 79 315 79 59 84 59 84 59 96 7 87 7 147 96 87 21 147 96 103 147 103 184 96 87 63 8 6 171 49 1 71 84 371 84 49 1 171 6 171

WATERSHED LOCATOR
LOUISIANA & TEXAS



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- Discovery Parish/County Boundary
- Other Parish/County Boundary

Hazus 1%-Annual-Chance Loss Study*

- Very Low
- Low
- Medium
- High
- Very High

*Flood risk data obtained from the FEMA Base Level Engineering study

Figure 11: Flood Risk - Potential Losses

TOLEDO BEND RESERVOIR WATERSHED

September 16, 2022

FEMA

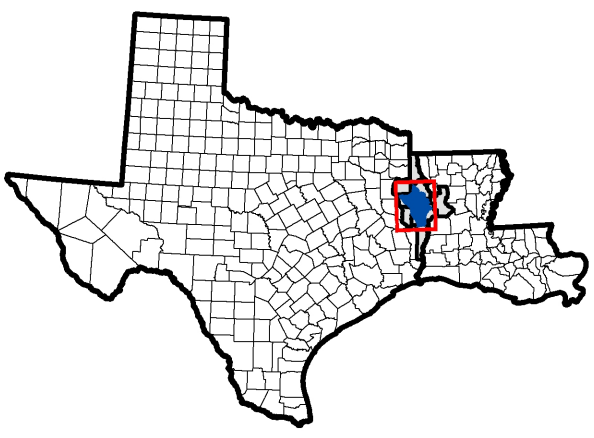
DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N

Caddo Parish
Caddo Parish
Bossier Parish
Bienville Parish
Red River Parish
Panola County
Keachi
Longstreet
Grand Cane
Mansfield
Logansport
Stanley
South Mansfield
De Soto Parish
Pleasant Hill
Converse
Natchitoches Parish
Noble
Zwolle
Shelby County
Texas
Nacogdoches County
San Augustine County
Toledo Bend Reservoir
Many
Sabine Parish
Sabine County
Louisiana
Vernon Parish
Jasper County
Newton County
SABINE RIVER
149
59
79
315
84
96
7
87
147
103
184
21
171
49
1
71
371
6
8
63

WATERSHED LOCATOR
LOUISIANA & TEXAS



Map Symbology

- Major Highways
- Watershed Boundary: HUC-8
- Sabine River
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish Boundary

Social Vulnerability Index (NRI 2021*)

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low

*NRI is the National Risk Index, created by the Federal Emergency Management Agency

Figure 12:

Social Vulnerability Index

TOLEDO BEND RESERVOIR WATERSHED

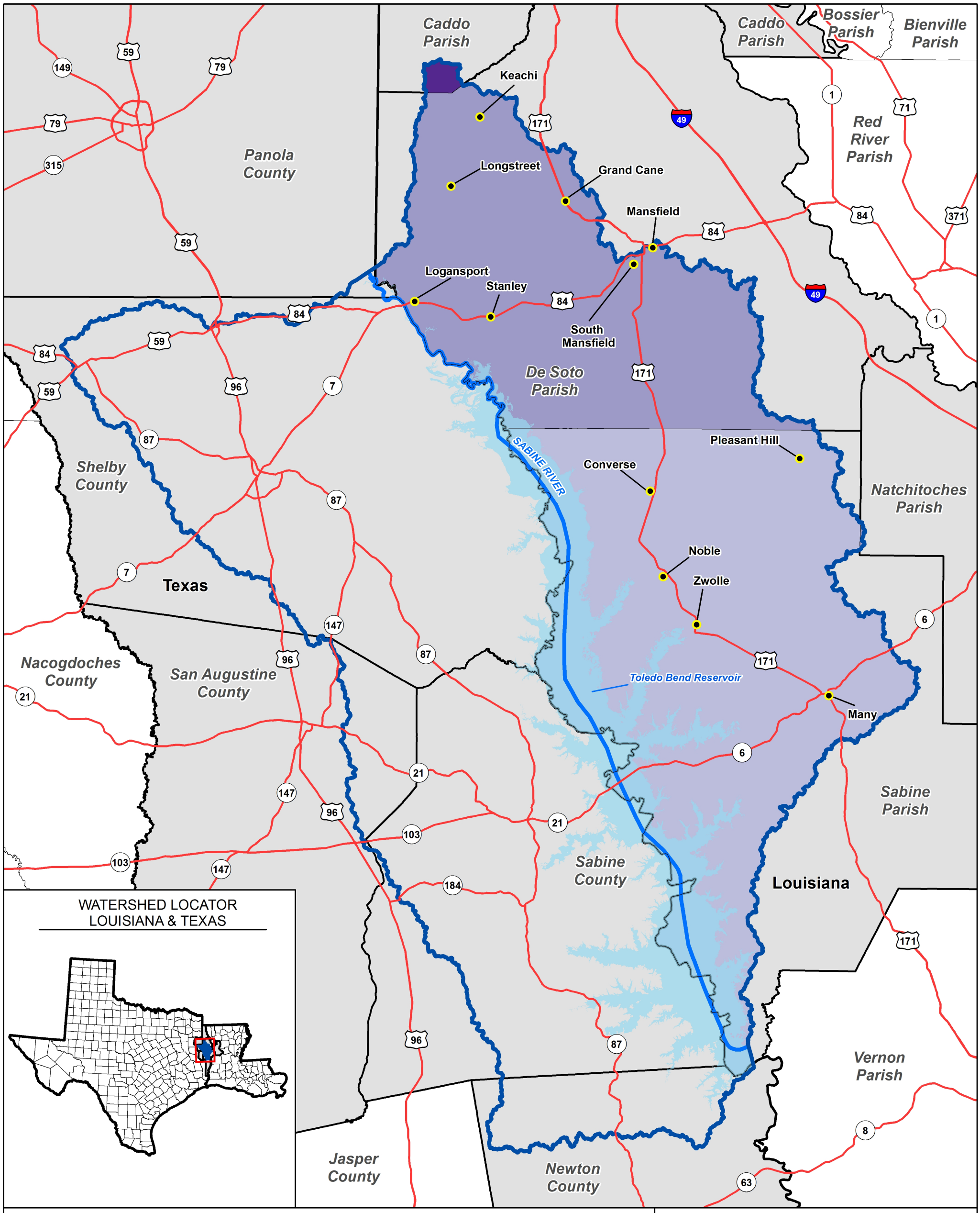
September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N



Map Symbology

- Major Highways
- Watershed Boundary: HUC-8
- Sabine River
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish Boundary

Resilience Rating (NRI 2021*)

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low

*NRI is the National Risk Index, created by the Federal Emergency Management Agency

Figure 13:

Resiliance Rating

TOLEDO BEND RESERVOIR WATERSHED

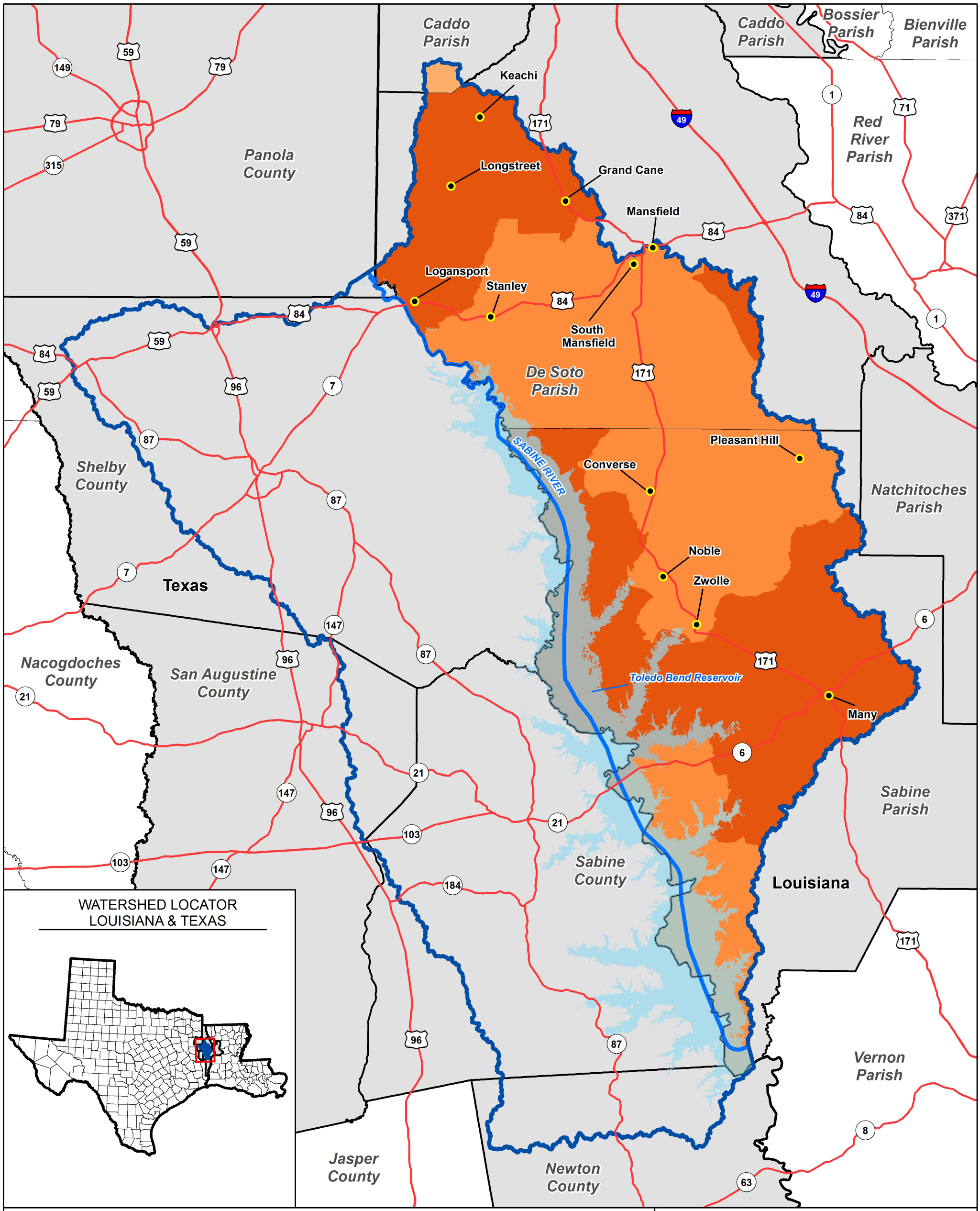
September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N



Map Symbology

- Major Highways
- Watershed Boundary: HUC-8
- Sabine River
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish Boundary

Riverine Flooding Risk Rating (NRI 2021*)

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low

*NRI is the National Risk Index, created by the Federal Emergency Management Agency

Figure 14:

Flood Risk Rating

TOLEDO BEND RESERVOIR WATERSHED

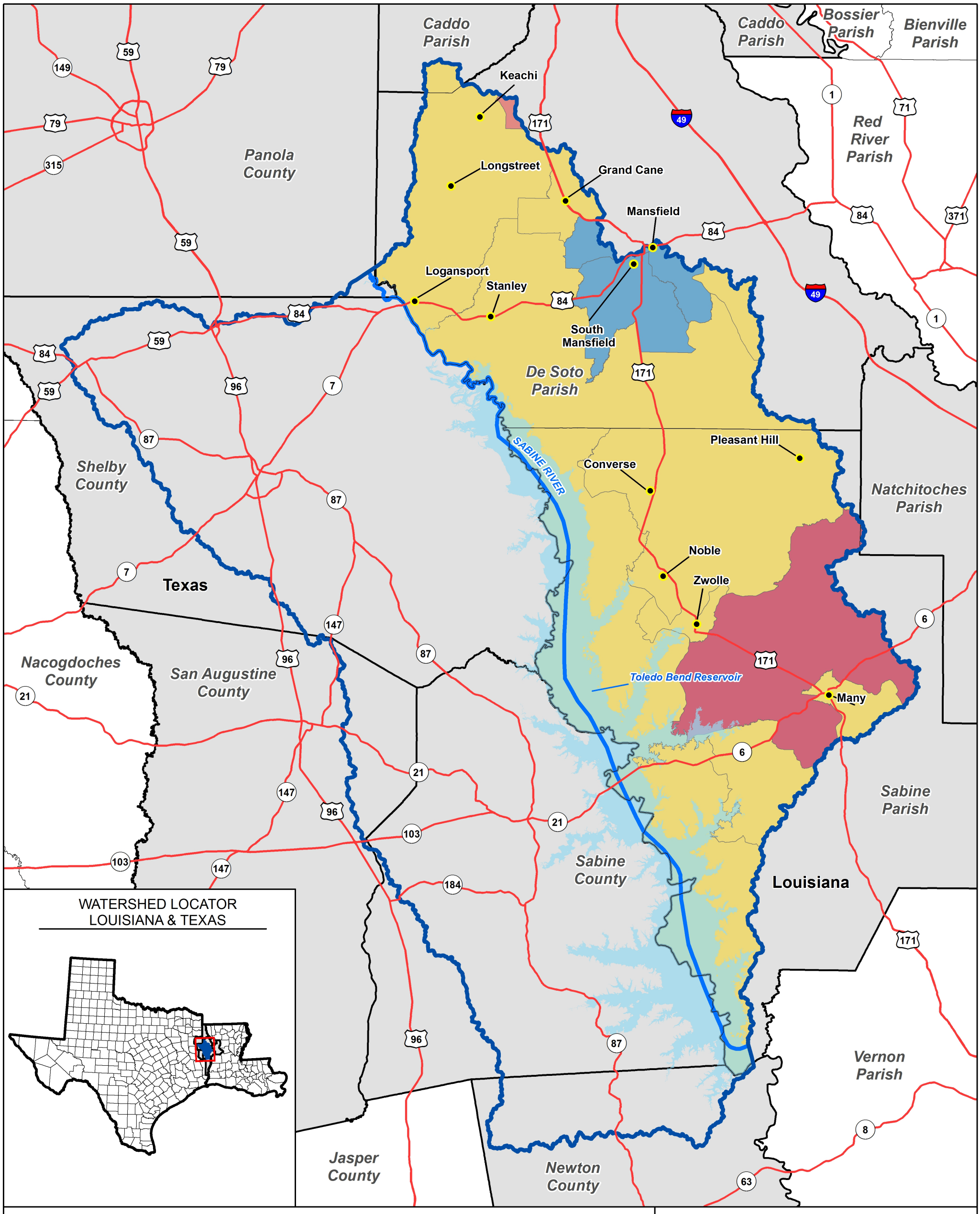
September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N



Map Symbology

- Major Highways
- Watershed Boundary: HUC-8
- Sabine River
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish Boundary

Population Exposed to Flooding (NRI 2021*)

- 0-10
- 11-145
- 146-293
- 294-428
- 429-820

*NRI is the National Risk Index, created by the Federal Emergency Management Agency

Figure 15:

Flood Risk Population Exposure

TOLEDO BEND RESERVOIR WATERSHED

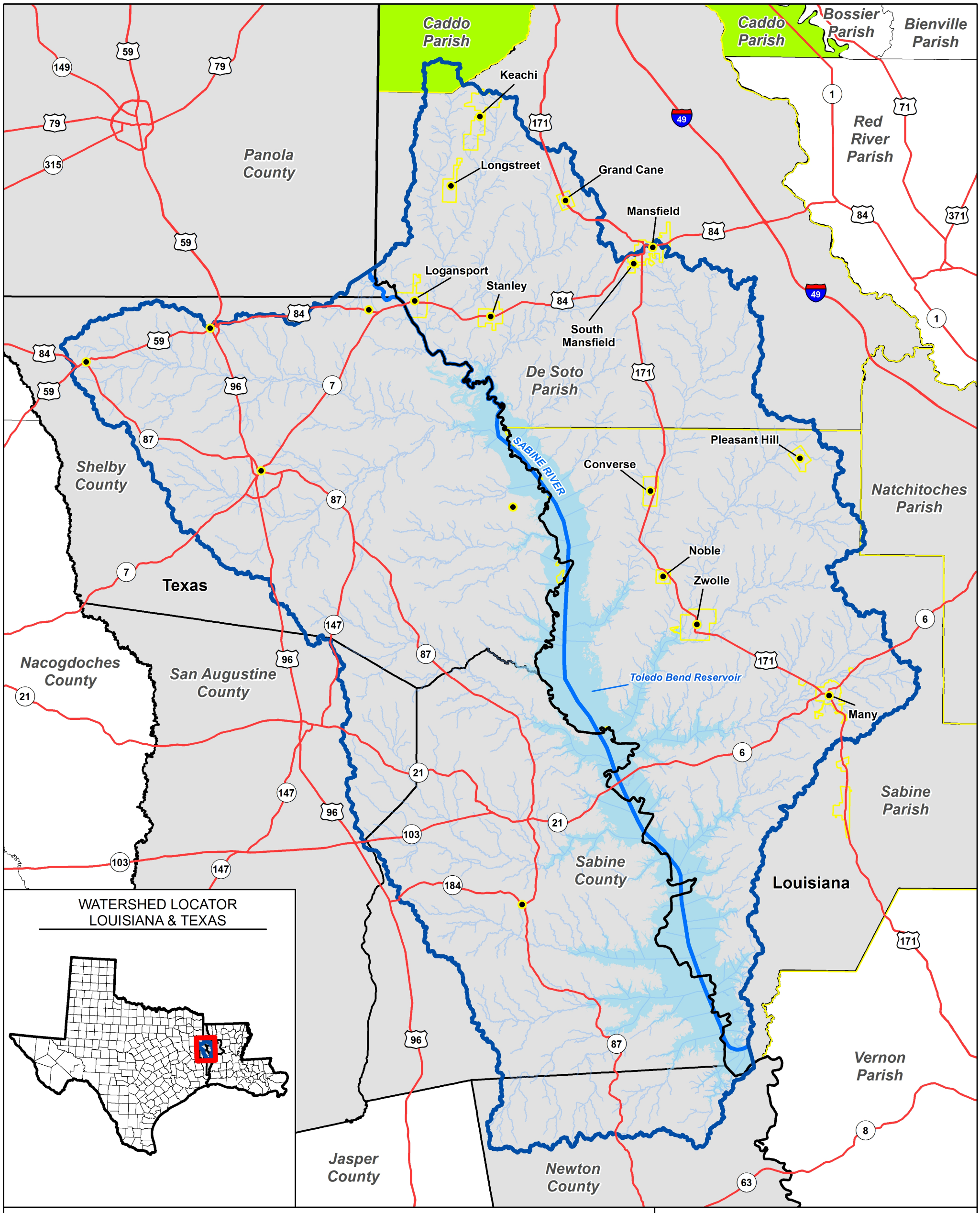
September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N



Map Symbology

- Cities
- Sabine River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

CRS Rating

- Not Participating
- 9 - Caddo Parish

Figure 16:
Community Rating System (CRS) Participating Communities

TOLDEO BEND RESERVOIR WATERSHED

September 16, 2022

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 4 8 Miles

N

Flood Risk Map

Flood Risk Map: *Toledo Bend Reservoir HUC 8 Watershed*

Ruby Dry Road Drainage Improvements, Longstreet, LA



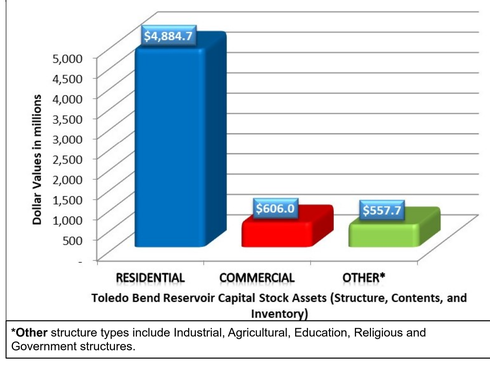
During stormwater events, Louisiana cities and towns know all too well the inconvenience and safety concern when roadways are overtopped by flood waters. Ruby Dry Road in Longstreet, Louisiana is one example of this occurrence. Mayor Connie Jackson indicated that this roadway has overtopped in the past and hinders residents from leaving or entering their property. Elevating this roadway as well as improving the drainage culverts and roadside ditch capacity would aid in reducing the flood water impacts to the community.

Gibbs Street Drainage Improvements, Mansfield, LA



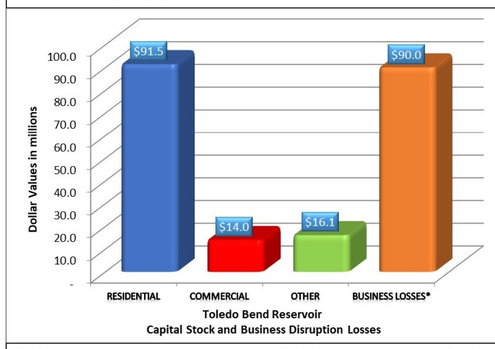
The City of Mansfield, located in DeSoto Parish, Louisiana, is no stranger to the drastic effects of stormwater flooding. In 2012, 2015, and 2020, it was reported that significant flooding occurred within the City limits, including water that entered into the local hospital forcing staff to relocate patients to the second floor. There was a fatality as a result of rushing flood waters at a nearby drainage lateral. Gibbs Street specifically, which runs in front of the DeSoto Regional Healthy System Hospital, appears to hold water for a duration after a heavy rain. Gibbs Street is a curb and gutter roadway with subsurface drainage. Improvements such as pipe replacement for increased capacity will promote positive drainage.

ASSET INVENTORY VALUES - TOLEDO BEND RESERVIOR WATERSHED HUC-8



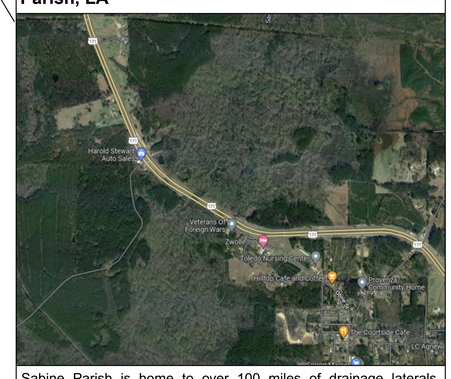
***Other** structure types include Industrial, Agricultural, Education, Religious and Government structures.

100-YEAR EVENT LOSSES - TOLEDO BEND RESERVIOR WATERSHED HUC-8



***Business Losses** are the sum of Inventory Loss, Relocation Cost, Income Loss, Rental Income Loss, Wage Loss and Direct Output Loss.

San Miguel Bayou Bridge Replacement, Sabine Parish, LA



Sabine Parish is home to over 100 miles of drainage laterals, including San Miguel Bayou. This bayou crosses under several roadways including Hwy 171 which was recorded to have overtopped by Parish representatives. There are currently two bridge structures along Hwy 171 that intersect San Miguel Bayou; elevating these structures as well as improving the waterway's cross section would aid in alleviating future flood occurrences.

MAP SYMBOLOGY

Base Data
- Major Roads
- Railroads
- State Boundary
- Watershed Boundary
- Waterbodies
- City Boundary
- County Boundary

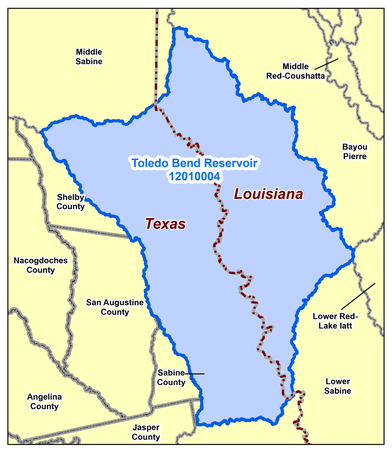
Flood Data
- Rivers and Streams
- New SFHA

Flood Risk*
- Very Low
- Low
- Medium
- High
- Very High

***Flood Risk Data Source**
Base Level Engineering (BLE) data and HAZUS Level 1 Analysis

Areas of Mitigation Interest
- Dams
- Stream Flow Constrictions
- Other Flood Risk Areas

WATERSHED LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

FRM FLOOD RISK MAP

Toledo Bend Reservior Watershed

FEMA

HUC-8 Code
12010004

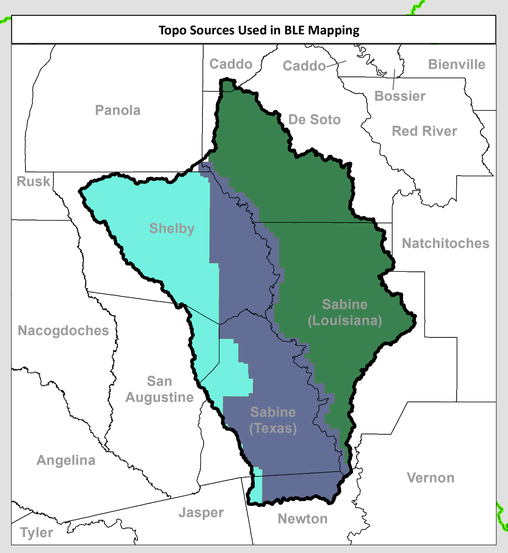
RELEASE DATE
03/29/2023

For more information of data used for this map, please consult the Toledo Bend Reservior Watershed Flood Risk Database and Flood Risk Report.

Pre-Discovery Map

Discovery Communities			
Community	CID	Total Flood Area Sq. Mi.	Percent of Community Floodplain within Toledo Bend Reservoir Watershed
Caddo Parish	220361	343.0	0.1%
DeSoto Parish	220363	169.1	41.5%
Grand Cane	220291	0.1	100.0%
Keachi	220297	0.5	100.0%
Logansport	220336	0.5	100.0%
Mansfield	220337	0.2	29.7%
South Mansfield	220313	0.1	100.0%
Newton County	480499	254.3	3.0%
Panola County**	480966	NA	NA
Sabine County**	480996	NA	NA
Hemphill	480997	<0.1	100.0%
Sabine Parish*	220368	263.4	82.4%
Converse*	220268	0.3	100.0%
Many*	220158	0.8	100.0%
Noble*	220301	0.1	100.0%
Pleasant Hill*	220344	0.3	100.0%
Zwolle*	220353	1.6	100.0%
San Augustine County*	481183	134.4	2.7%
Shelby County*	481004	122.4	86.0%
Center*	480566	0.3	100.0%
Huxley*	481311	0.0	100.0%
Joaquin*	481005	0.1	100.0%
Tenaha*	481006	0.2	54.7%
Timpson*	481007	<0.1	100.0%
*No Digital National Flood Hazard Layers Available. Floodplain in watershed taken from Q3.			
**No flood mapping for unincorporated portion of county.			

Toledo Bend Reservoir



Topo Sources Used in BLE Mapping

- 2008 Louisiana Statewide LIDAR
- 2016 FEMA Naches Basin QL2 LIDAR
- 2018 NRCS Eastern Texas LIDAR

N

0 2.5 5 10 15 Miles

Map Symbology

- USGS Gage
- LOMC
- High Water Mark
- Low Water Mark
- Dam
- Lake
- City Boundary
- County Boundary
- Watershed Boundary

SHIELD

- Interstate Highway
- US Highway
- State Highway
- Railroad

Effective FEMA Floodplains*

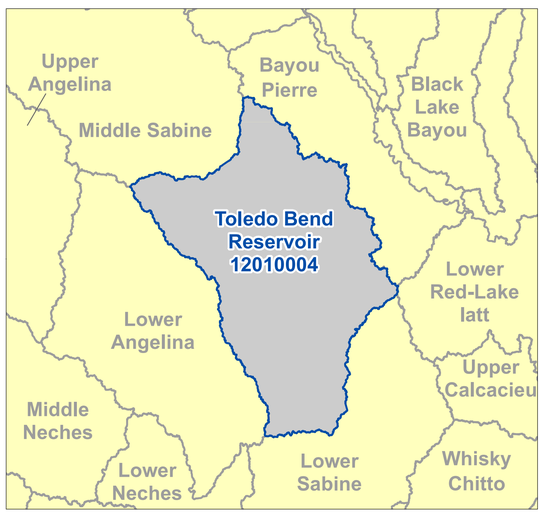
- Floodway
- Zone AE, VE, AO (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zones AH, 100-Year Depth <1 Foot; X500 (500-Year, Detailed)
- Zone X, Reduced Flood Risk Due to Levee

Effective Streams Study Type*

- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zone X (Unshaded X, Areas of Minimal Flood Risk)

***Data as of April 2019**

WATERSHEDS LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Pre-Discovery Map

TOLEDO BEND RESERVOIR WATERSHED, LOUISIANA AND TEXAS

Stream Miles:	2,714
Zone AE Miles:	40
Zone A Miles:	1,370
Zone X Miles:	1,331
Population:	49,572

HUC-8 Codes
12010004

FEMA

Discovery Map

Parish	CID	Population [1]	Number of Policies	Total Coverage	Total Losses [2]	Total Payments [2]	Current FEMA DFIRM Status	Oldest Effective Date
Caddo Parish	220361	37,805	628	$ 161,861,700.00	433	$ 13,618,732.00	Modernized	5/19/2014
Natchitoches Parish	220129	16,406	381	$ 82,470,700.00	429	$ 8,342,885.00	Modernized	7/6/2015
Sabine Parish	220368	16,000	74	$ 16,943,800.00	16	$ 405,023.00	Modernized	8/5/1991
De Soto Parish	220363	26,812	61	$ 11,780,700.00	26	$ 508,878.00	Modernized	12/16/2003

[1] Total community population based on 2020 Decennial Census data

[2] Based on available NFIP claims data as of February 2022

Total Losses - All losses submitted regardless of the status.

Total Payments - Total amount paid on losses.

Discovery Communities			
Community	CID	Total Flood Area Sq. Mi.	Percent of Community Floodplain within Toledo Bend Reservoir Watershed
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DeSoto Parish	220363	169.1	41.5%
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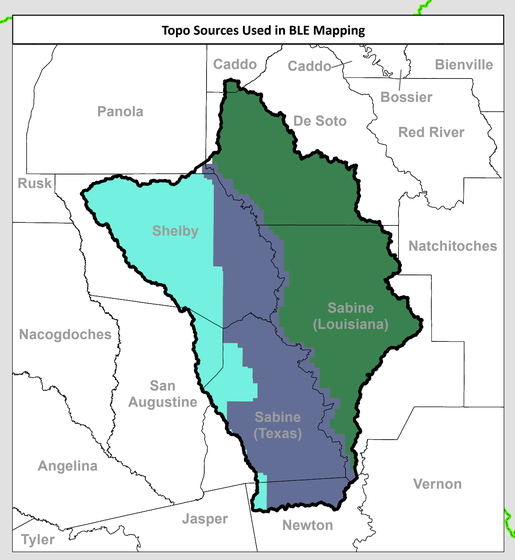
*No Digital National Flood Hazard Layers Available. Floodplain in watershed taken from Q3.

**No flood mapping for unincorporated portion of county.

Harrison
Bossier
Bienville
Caddo
Rusk
Panola
De Soto
Red River
Shelby
Natchitoches
Nacogdoches
San Augustine
Sabine
Angelina
Jasper
Newton
Vernon

Toledo Bend Reservoir



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- 2018 NRCS Eastern Texas LIDAR

N

0 2.5 5 10 15 Miles

Map Symbology

- USGS Gage
- LOMC
- High Water Mark
- Low Water Mark
- Dam
- Lake
- City Boundary
- County Boundary
- Watershed Boundary

Major Roads

- US Highway
- State Highway
- Railroad

Effective FEMA Floodplains*

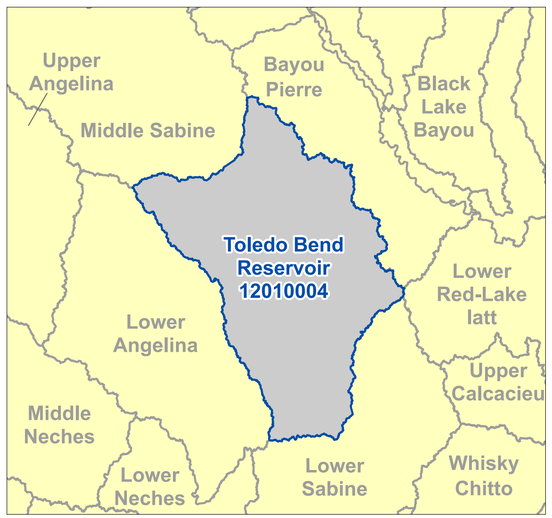
- Floodway
- Zone AE, VE, AO (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zones AH, 100-Year Depth <1 Foot; X500 (500-Year, Detailed)
- Zone X, Reduced Flood Risk Due to Levee

Effective Streams Study Type*

- Zone AE (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zone X (Unshaded X, Areas of Minimal Flood Risk)

***Data as of April 2019**

WATERSHEDS LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Discovery Map

TOLEDO BEND RESERVOIR WATERSHED, LOUISIANA AND TEXAS

Stream Miles:	2,714
Zone AE Miles:	40
Zone A Miles:	1,370
Zone X Miles:	1,331
Population:	49,572

HUC-8 Codes
12010004

FEMA

Post-Discovery Map

CNMS Validation Status Definitions	
Assessed	Unmapped Streams or streams not part of FEMA's SFHA inventory that have been investigated and considered for study in current and/or future Fiscal Years (FYs).
Unverified	Stream has not passed the Critical and Secondary Element checks (At least one critical or four or more secondary change conditions flagged) and may either be assigned resources for restudy in current and/or future FYs.
Valid	Streams considered New, Validated, or Updated Engineering (NVUE) compliant (zero critical and fewer than four secondary elements flagged).
To Be Studied	Mapped streams that need to be studied and are planned for a future FY or unmapped streams prioritized to be mapped with a SFHA.

Harrison
Bossier
Bienville
Caddo
Rusk
Panola
De Soto
Red River
Rusk
Shelby
Natchitoches
Nacogdoches
Toledo Bend Reservoir
San Augustine
Sabine
Vernon
Sabine
Angelina
Jasper
Newton

N
0 2.5 5 10 15 Miles

Map Symbology

- USGS Gage
- LOMC
- High Water Mark
- Low Water Mark
- Dam
- Lake
- City Boundary
- County Boundary
- Watershed Boundary

Transportation
- US Highway
- State Highway
- Railroad

Effective FEMA Floodplains*
- Floodway
- Zone AE, VE, AO (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zones AH, 100-Year Depth <1 Foot; X500 (500-Year, Detailed)
- Zone X, Reduced Flood Risk Due to Levee

VALIDATION STATUS, STATUS TYPE**
- Unverified, Being Studied
- Unverified, To Be Studied
- Assessed, Being Studied
- Valid, Being Studied
- Valid, NVUE Compliant

***Data as of April 2019**

WATERSHEDS LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Post-Discovery Map

TOLEDO BEND RESERVOIR WATERSHED, LOUISIANA AND TEXAS

Stream Miles:	2,714
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Population:	49,572

HUC-8 Codes
12010004

FEMA

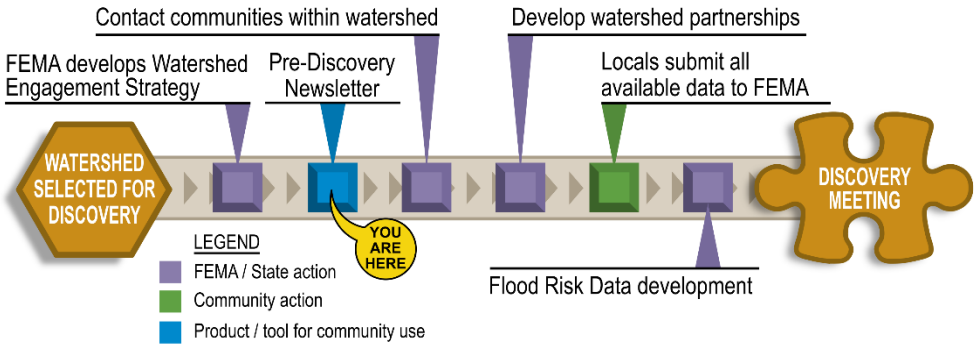
Pre-Discovery Newsletter

Pre-Discovery Newsletter
Toledo Bend Reservoir, Lower Red-Lake Iatt, Whisky Chitto & Upper Calcasieu Watersheds

"Capturing a More Complete Picture of Your Community and Your Watershed" *January 2022*

Risk MAP Process and Discovery

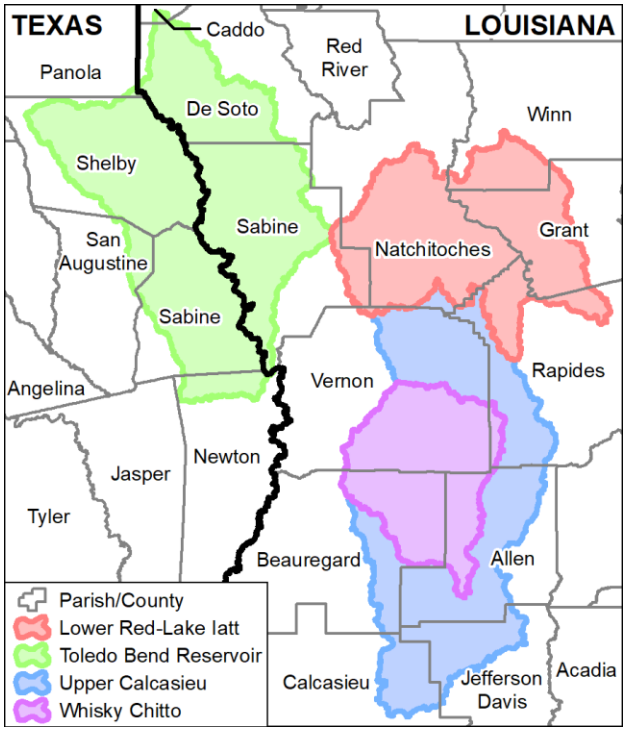
Risk Mapping, Assessment, and Planning (Risk MAP) is the Federal Emergency Management Agency (FEMA) Program that assists communities with flood information and tools they can use to enhance their mitigation plans and better protect their citizens. Discovery is the first phase of an overall process to achieve mitigation actions for reducing risks. The Louisiana Department of Transportation & Development (DOTD) has been awarded a FEMA grant to conduct Discovery in the Toledo Bend Reservoir, Lower Red-Lake Iatt, Whisky Chitto & Upper Calcasieu Watersheds in 2022.



The Goal: To work closely with communities to better understand local flood risk, mitigation efforts, and other topics to spark watershed-wide discussions about increasing resilience to flooding.

Pre-Discovery Meeting
January 19th, 2022
10:00 AM

Online invitations for Webex Meeting to be sent out soon



Pre-Discovery Meeting

In preparation for the upcoming Discovery Meetings, DOTD will be hosting one Pre-Discovery meeting via Webex call. This meeting will introduce you to flood risk data being developed in the watershed, inform you about what to expect at the Discovery Meeting, describe who should attend, and communicate the data we need to collect from your community. Invitations to the meeting are currently being sent out. The meeting will be recorded and posted online should your community be unable to join the Webex call.

Requested Data from Communities

- Areas of recurring flooding
- Historical local flooding locations
- High water marks or flood photos documented from historical flood events
- Infrastructure information, especially for levees and new bridges, dams, culverts and road improvements
- Mitigation activities and grant projects (ongoing or planned)
- Local development and floodplain management plans
- Stormwater management activities
- Regional watershed plans
- Flood study needs

Customize Discovery:
After the meeting, enter your community's data at:
https://dotd.discovery.halff.com
Password: DOTD_FY20!

Discovery Data Collection

The section to the left lists some of the types of data requested from each community within the watershed. We would greatly appreciate your participation in providing mapping needs and flood risk data for your community.

DOTD requests communities share whatever data they have, to provide as complete a picture as possible.

The Louisiana Department of Transportation & Development is a FEMA Cooperating Technical Partner (CTP), which allows them to collaborate with FEMA to help maintain current flood hazard information. The results from Base Level Engineering (BLE) studies served as a reference for the Mapping Activity Statement (MAS) of the FEMA CTP grant. FEMA awarded a CTP grant to DOTD to perform Discovery in these watersheds. The current MAS is included in the Risk MAP program. **Please contact Susan Veillon (Susan.Veillon@la.gov) if you have questions about Discovery.**

Pre-Discovery Meeting Slides

FEMA

RiskMAP
Increasing Resilience Together

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

LOUISIANA DISCOVERY

"CAPTURING A MORE COMPLETE PICTURE OF YOUR WATERSHED"

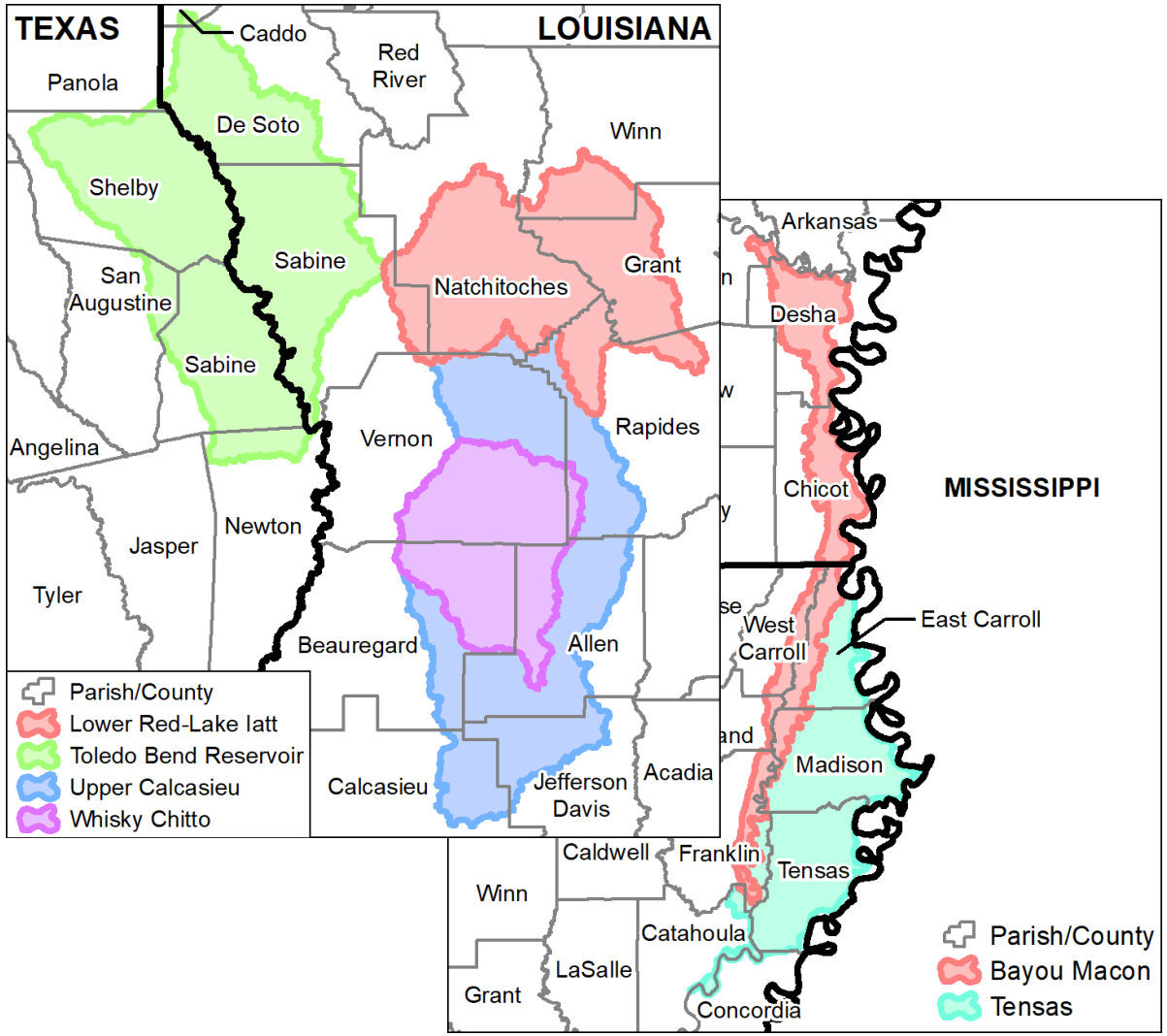
PRE-DISCOVERY MEETING

JANUARY 19, 2022

HALFF

AGENDA

- Overview of Risk MAP
- Discovery Overview
- LaDOTD Discovery Activities
  - Pre-Discovery Activities
  - Discovery Activities
  - Post-Discovery Activities
- 2022 LaDOTD Discovery Watersheds
  - Northeast Watersheds: Tensas & Bayou Macon
  - Southwest Watersheds: Toledo Bend Reservoir, Lower Red-Lake Iatt, Upper Calcasieu & Whisky Chitto
- Data Gathering Website and Walk-through



HALFF

FEMA

RiskMAP
Increasing Resilience Together

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

DISCOVERY OVERVIEW

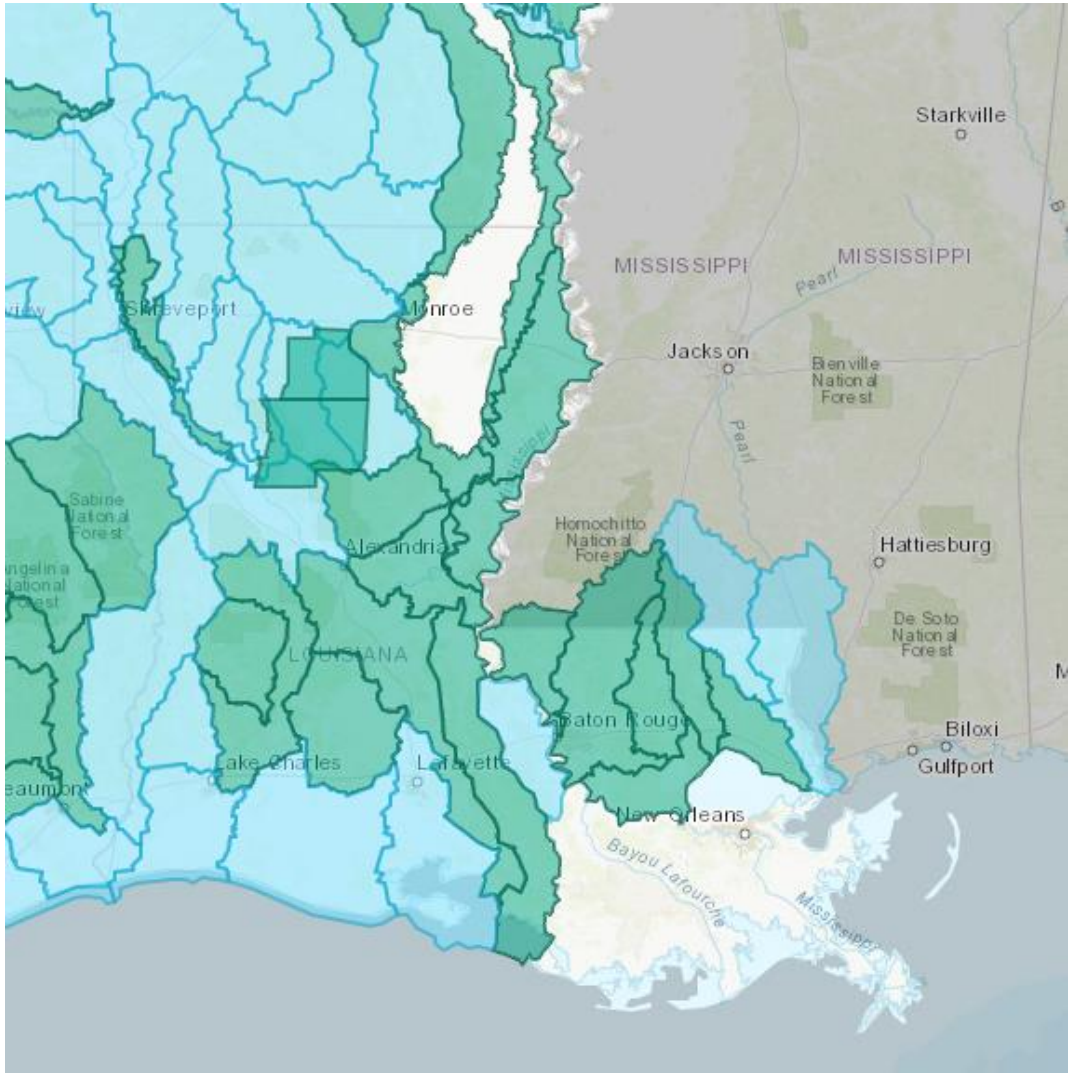
Discovery is FEMA's process for identifying and accessing flood risk to better prepare a list of needs and projects to address those needs within communities.

- Heighten community involvement and understanding
- Gather all flood-related information available
  - Knowledge of Flood Risks and Past Flooding in your community
  - Hazard Mitigation Projects – ongoing, planned or completed
  - Master Drainage Plans and floodplain studies – ongoing, planned or completed
  - Current flood risk communication process
  - GIS data

DISCOVERY OVERVIEW

- Request needs in the community
  - Questions and concerns for DFIRM maps
  - All questions and concerns for dams and levees
  - Study request in areas of repetitive loss
  - Areas of new development or other causes of concern for the future
  - Funding needs for identified flood risk projects

FEMA'S RISK MAP PROGRAM





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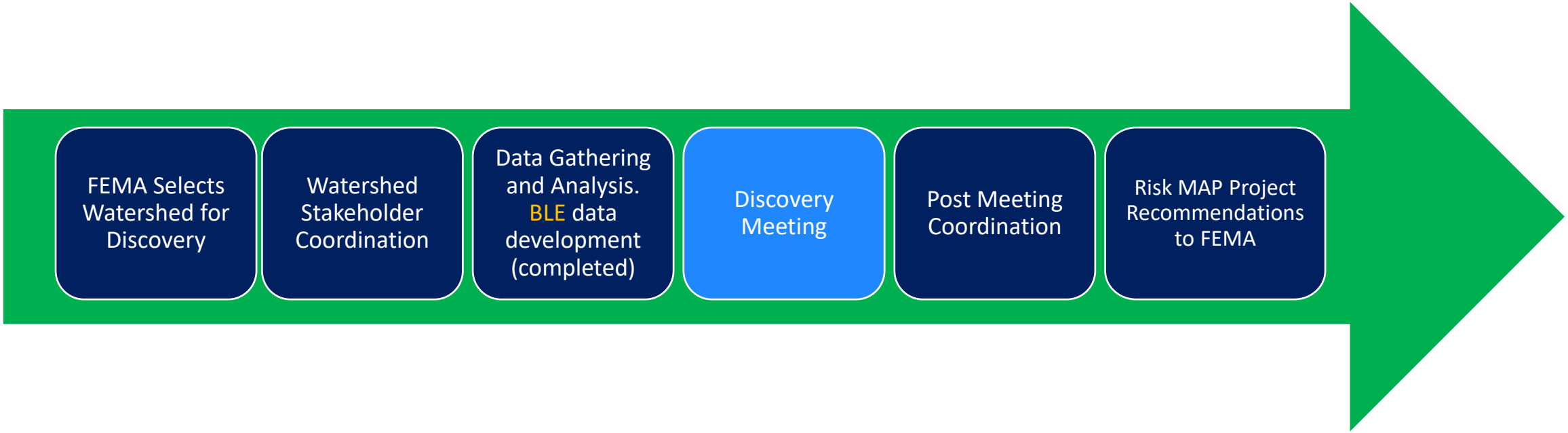
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

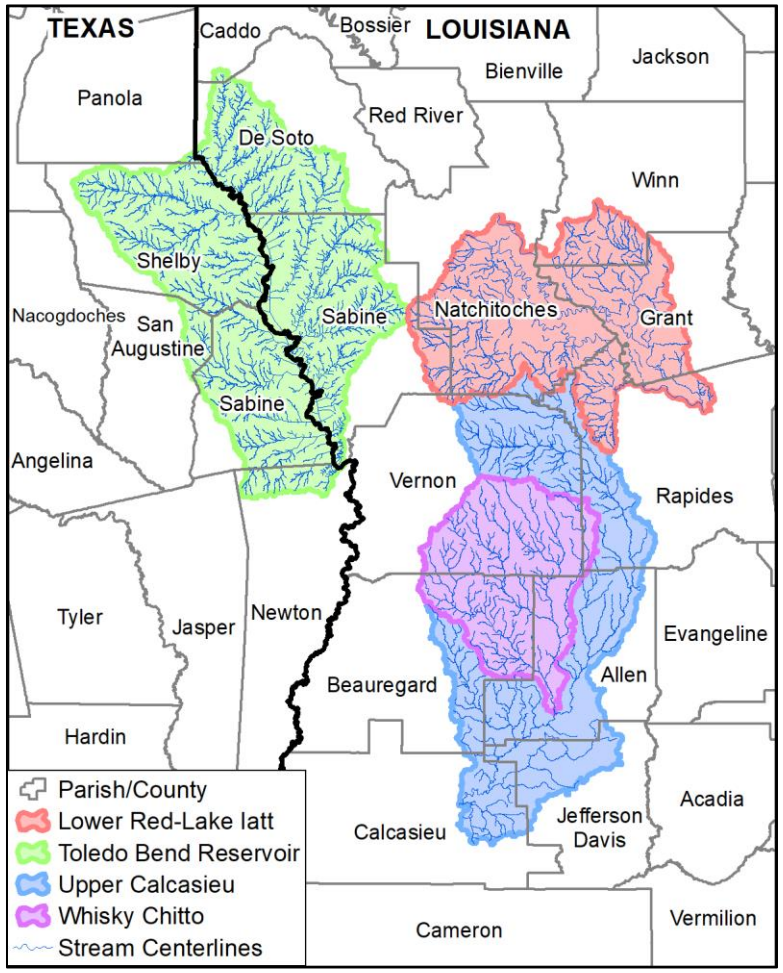
DISCOVERY STEPS

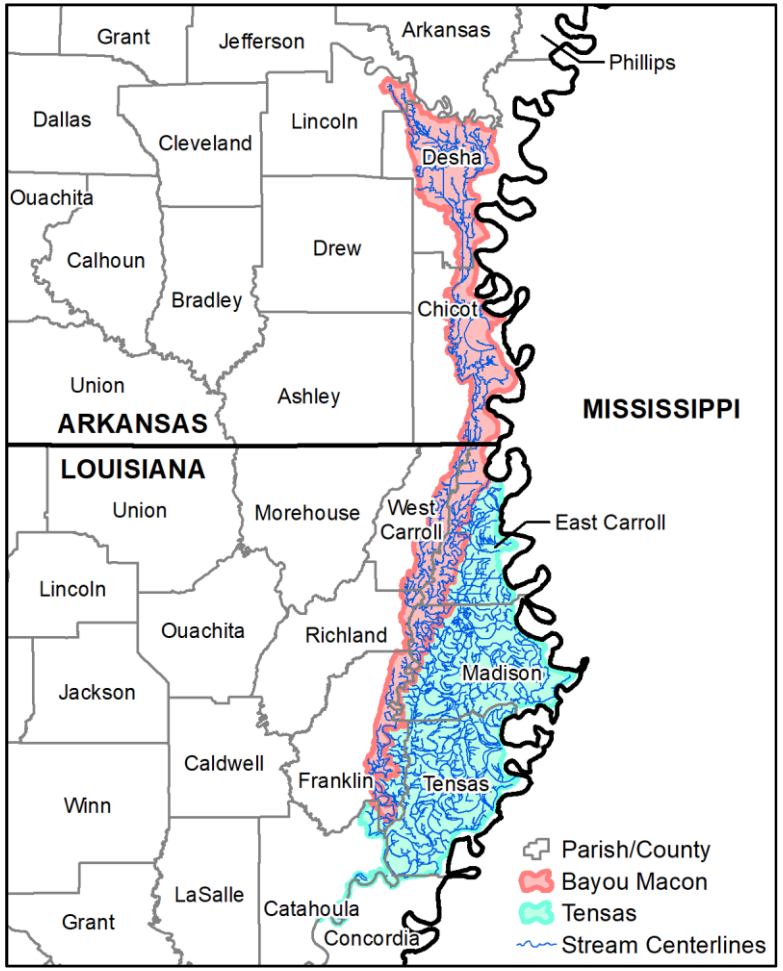
- ***Capture a more complete picture of your watershed by working closely with local communities…***



Louisiana Watersheds Discovery

- Goals
  - Inform Community of Present Flood Risk
  - Gather local data to supplement National, Regional and State data
  - Present FEMA with areas of highest concern and need for additional study





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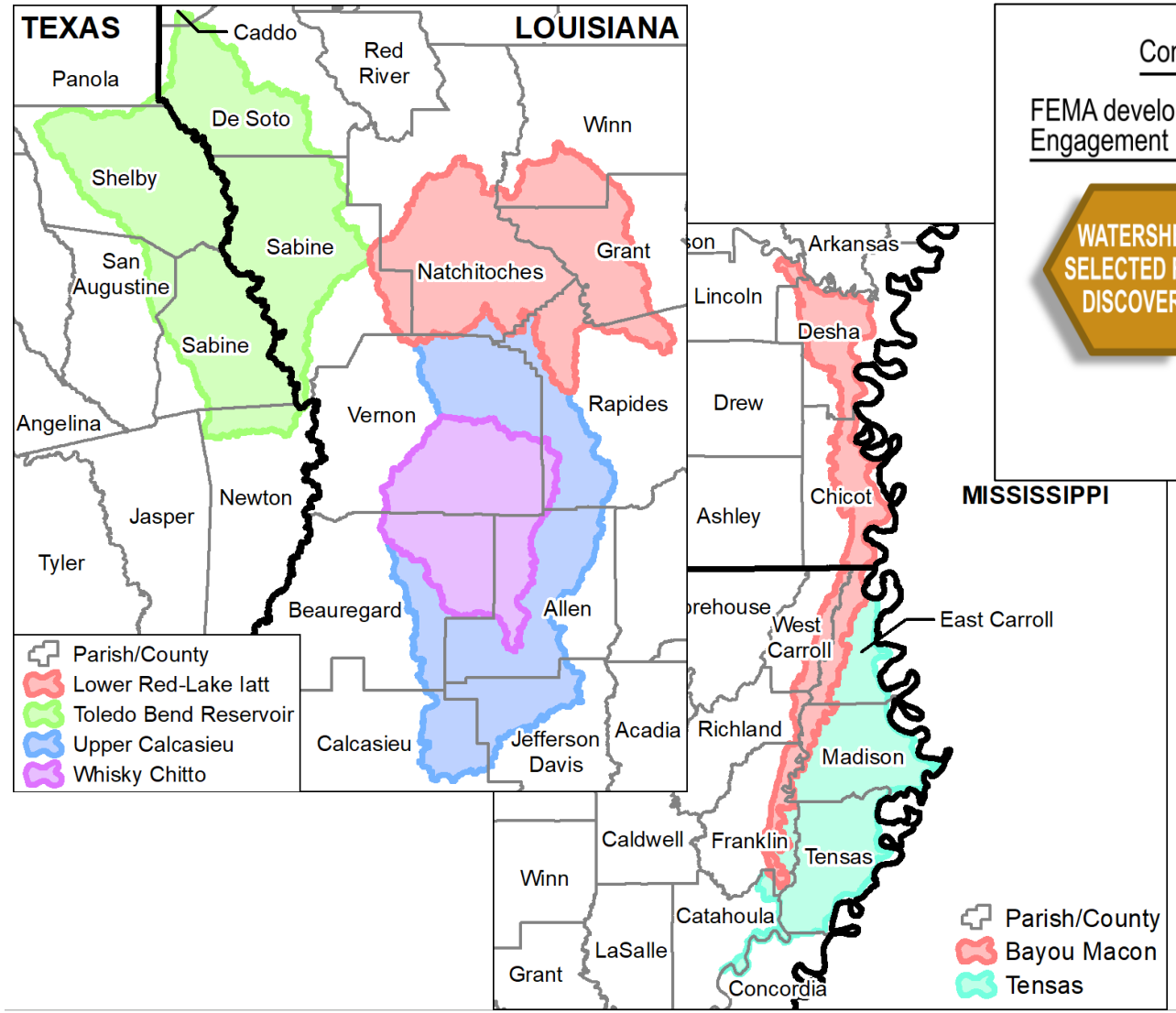
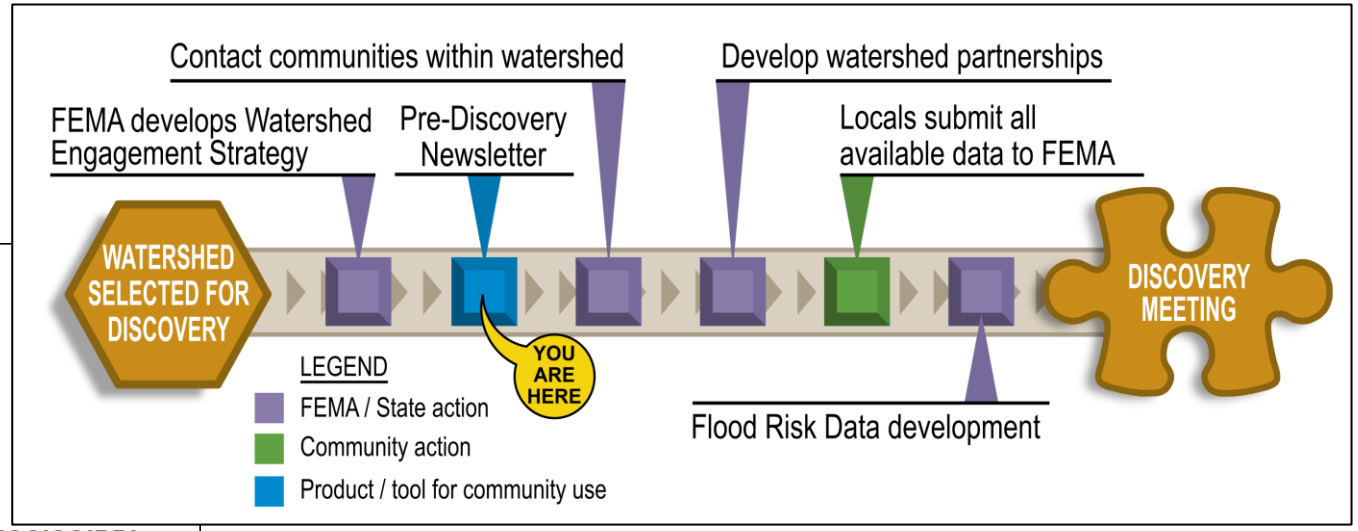
DISCOVERY NEWSLETTER





Pre-Discovery Meeting
January 19th, 2022
10:00 AM

Online invitations for Webex Meeting to be sent out soon

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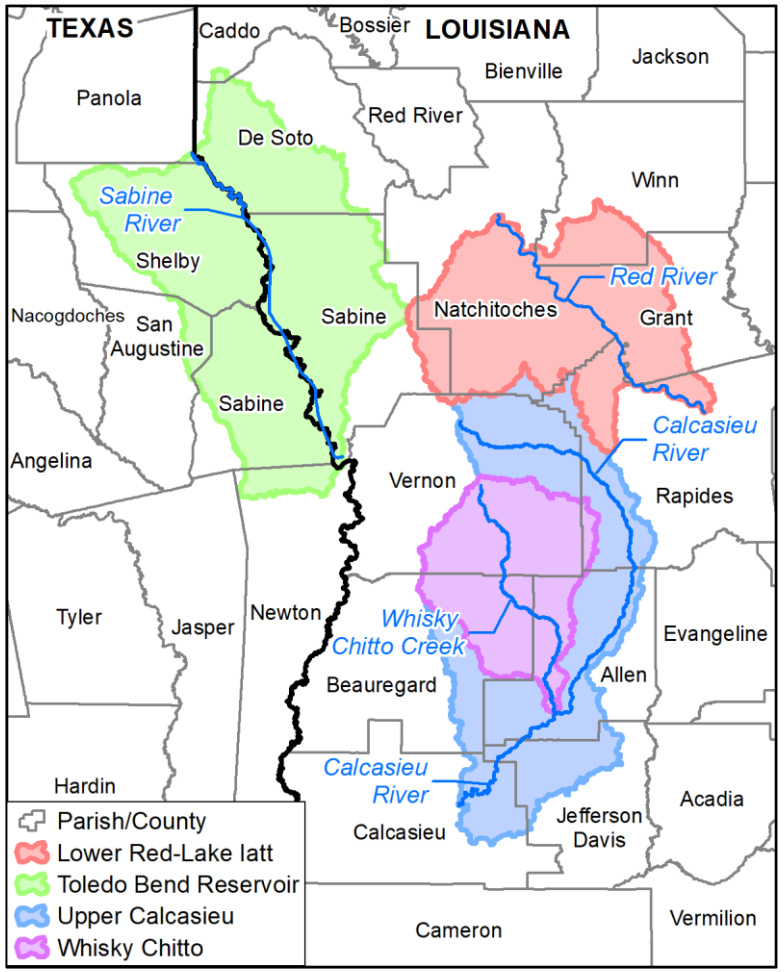
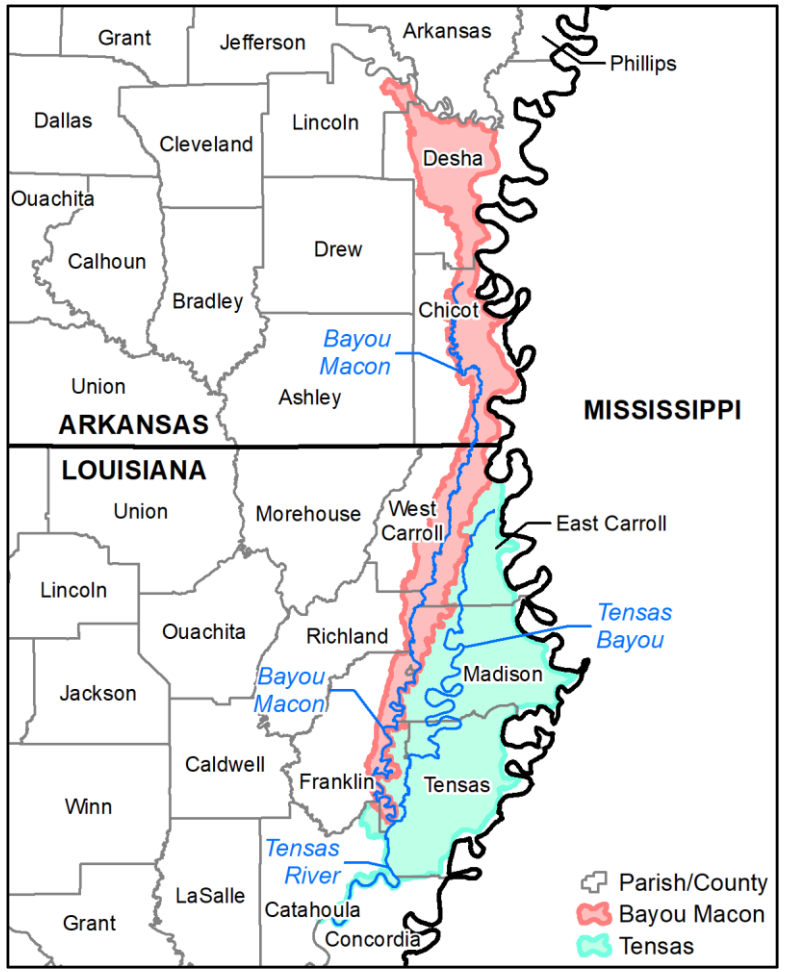
What information are we interested in?



BASE LEVEL ENGINEERING (BLE)

- BLE is developed at a larger scale (HUC8)
- LiDAR must be available
- Steps of Hydrology, Hydraulics & Terrain
- Model review and adjustments
- Gage review included in hydrology
- Used to assess flood risk





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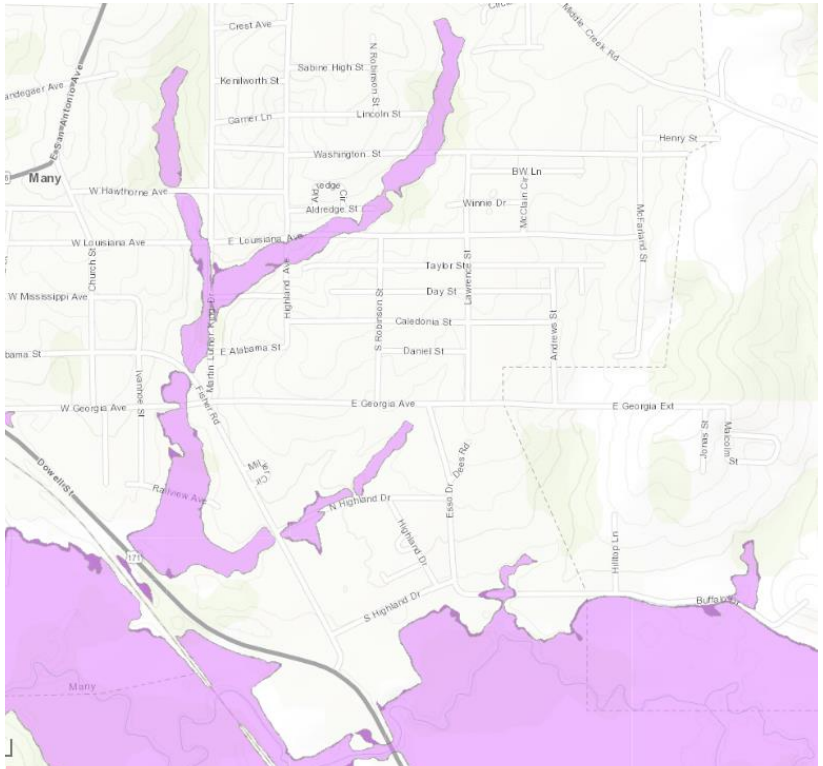
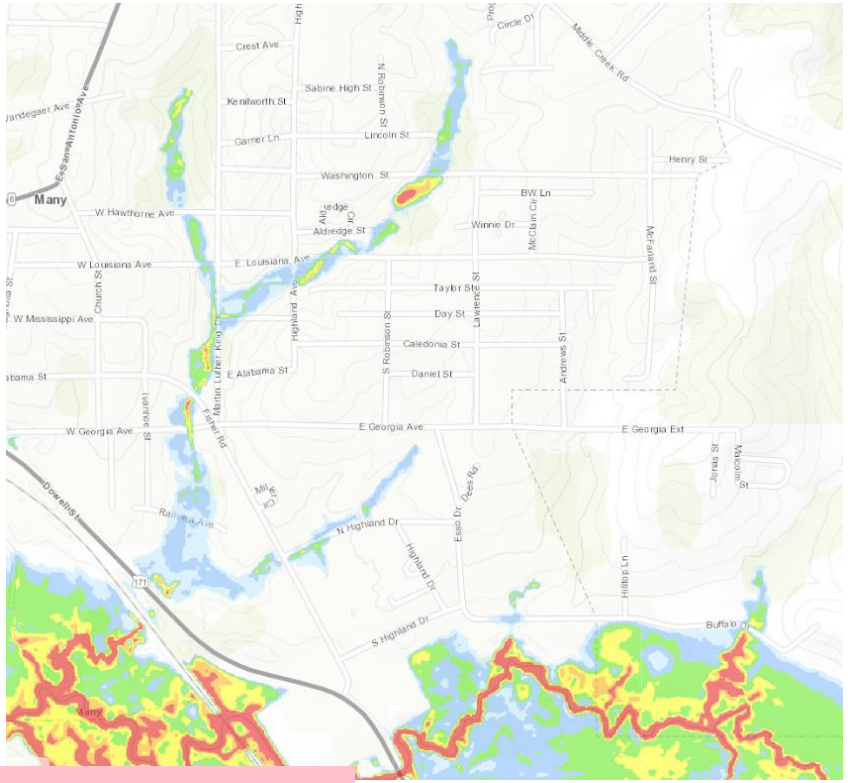
BASE LEVEL ENGINEERING (BLE)





High risk (1% flood zone)

Low to moderate risk (0.2% flood zone)

≤ 1 foot	> 3 to 4 feet
> 1 to 2 feet	> 4 to 5 feet
> 2 to 3 feet	> 5 feet

OUTPUTS

- Hydrology modeling (Regression) flows w/gage analysis
- Hydraulic modeling (HEC-RAS) for 10%, 4%, 2%, 1% and 0.2% storm events
- 10%, 1% and 0.2% floodplain boundaries

Non-Regulatory

- Areas of Expanded Flood Risk
- Depth and Analysis Grids
- Flood Risk Assessment

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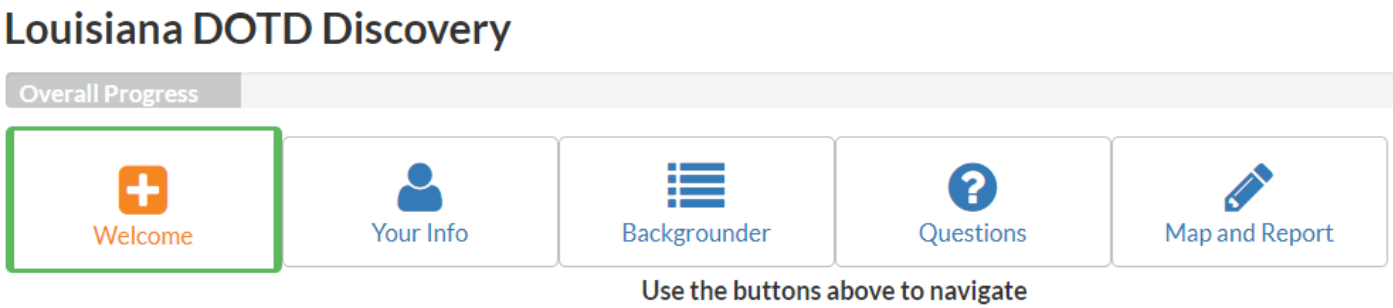
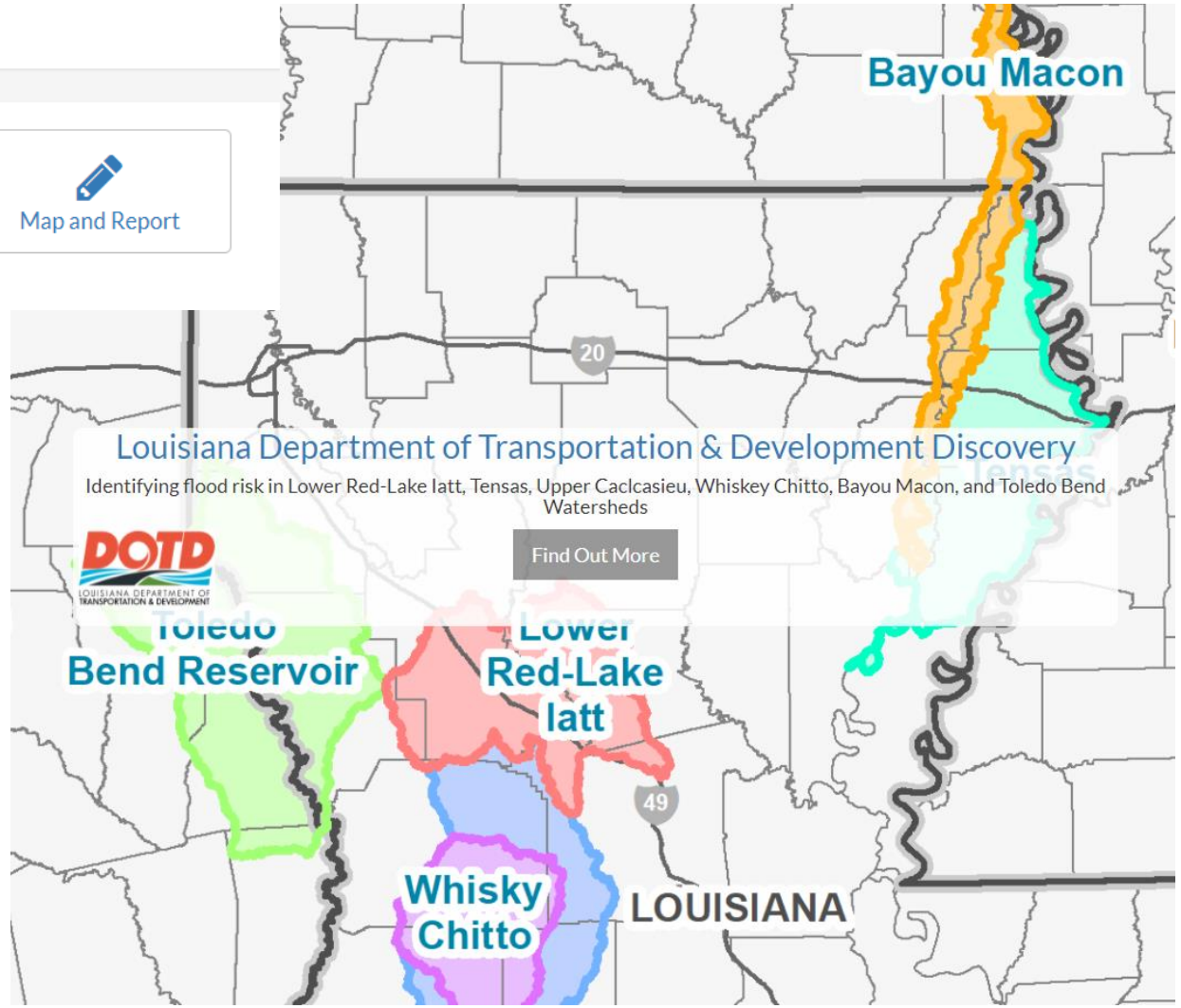
DISCOVERY MEETINGS – PREPARATION



- Enter your data online before the meeting
- Discovery meetings in March
- All community stakeholders are encouraged to attend



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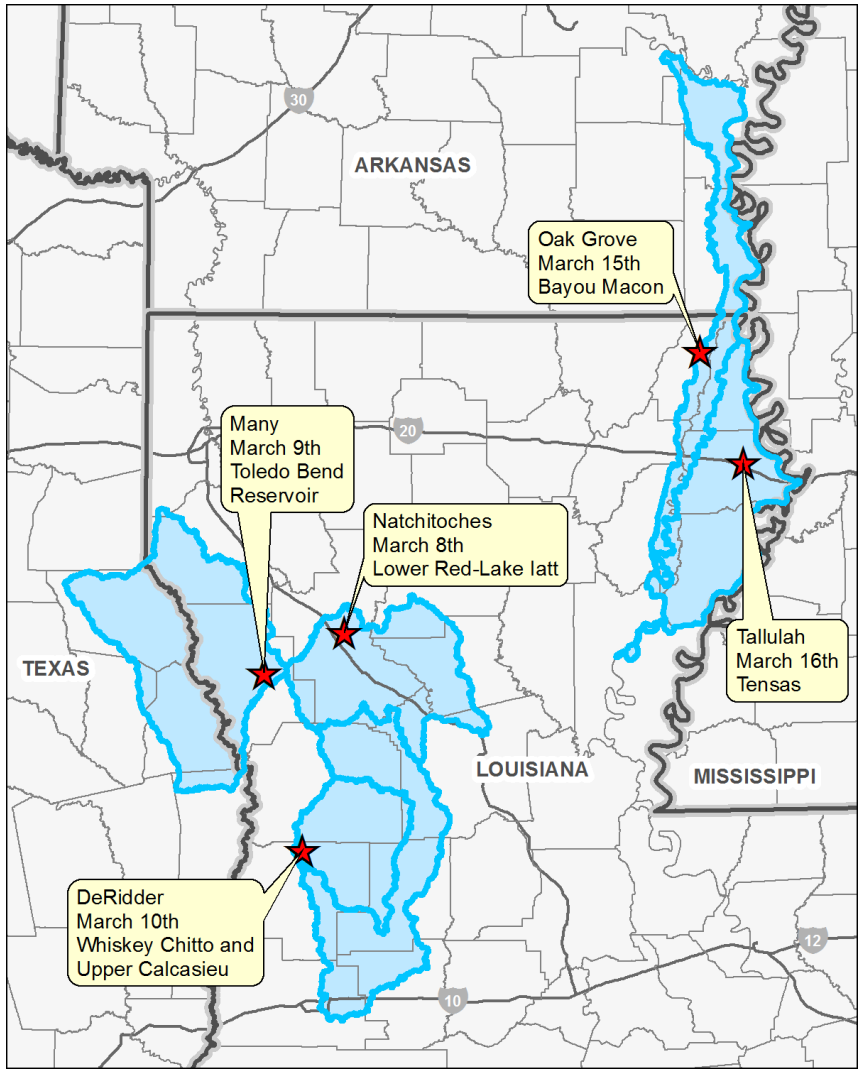
DISCOVERY MEETINGS – LOCATIONS

- Southwest Watersheds
  - March 8th – Natchitoches
  - March 9th – Many
  - March 10th – DeRidder
- Northeast Watersheds
  - March 15th – Oak Grove
  - March 16th – Tallulah



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DISCOVERY MEETINGS – WHAT TO EXPECT

- "Come and Go" format
- Open conversation
- Serves as additional meeting point beyond the webmap
- Groups present:
  - Federal, State, and Regional Agencies
  - Community Officials and other local stakeholders

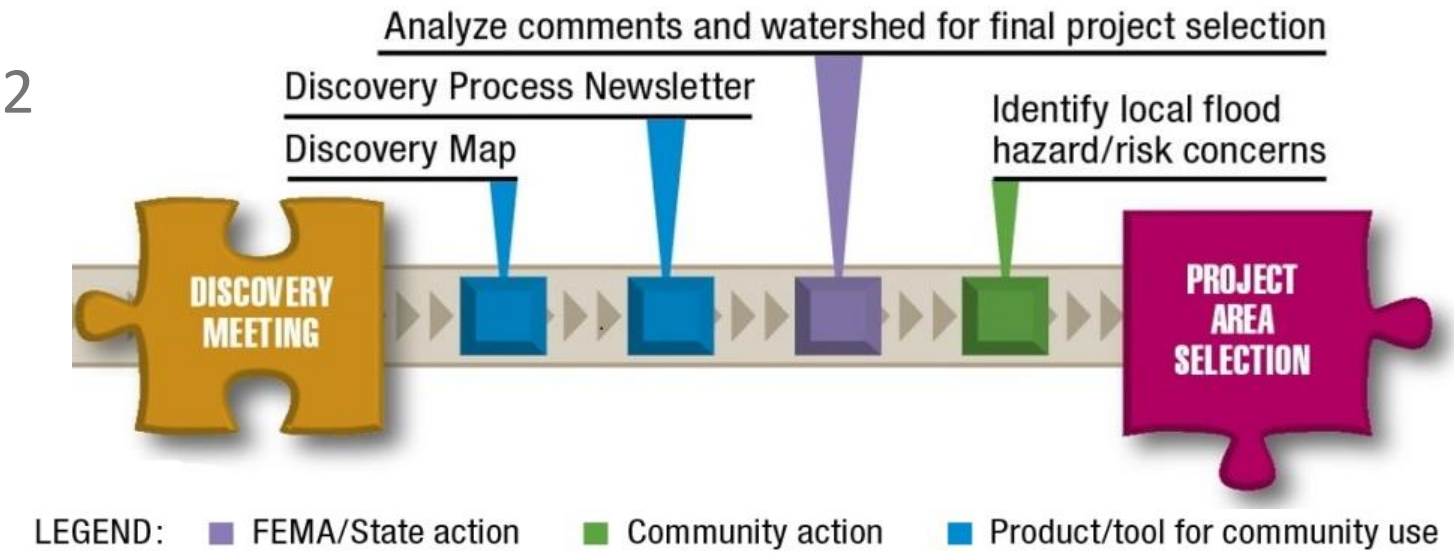


DISCOVERY MEETINGS – WHAT YOU SHOULD BRING

- Knowledge of Flood Risks and Past Flooding in your community
- Hazard Mitigation Projects – Identified, In Progress, or Complete?
- Master Drainage Plan(s), floodplain studies – completed or identified as needs
- Questions or Concerns regarding your current Digital Flood Insurance Rate Maps – Flood Study Needs
- Current Flood Risk Communication Process
- Dams and Levees – Questions or Concerns
- GIS data

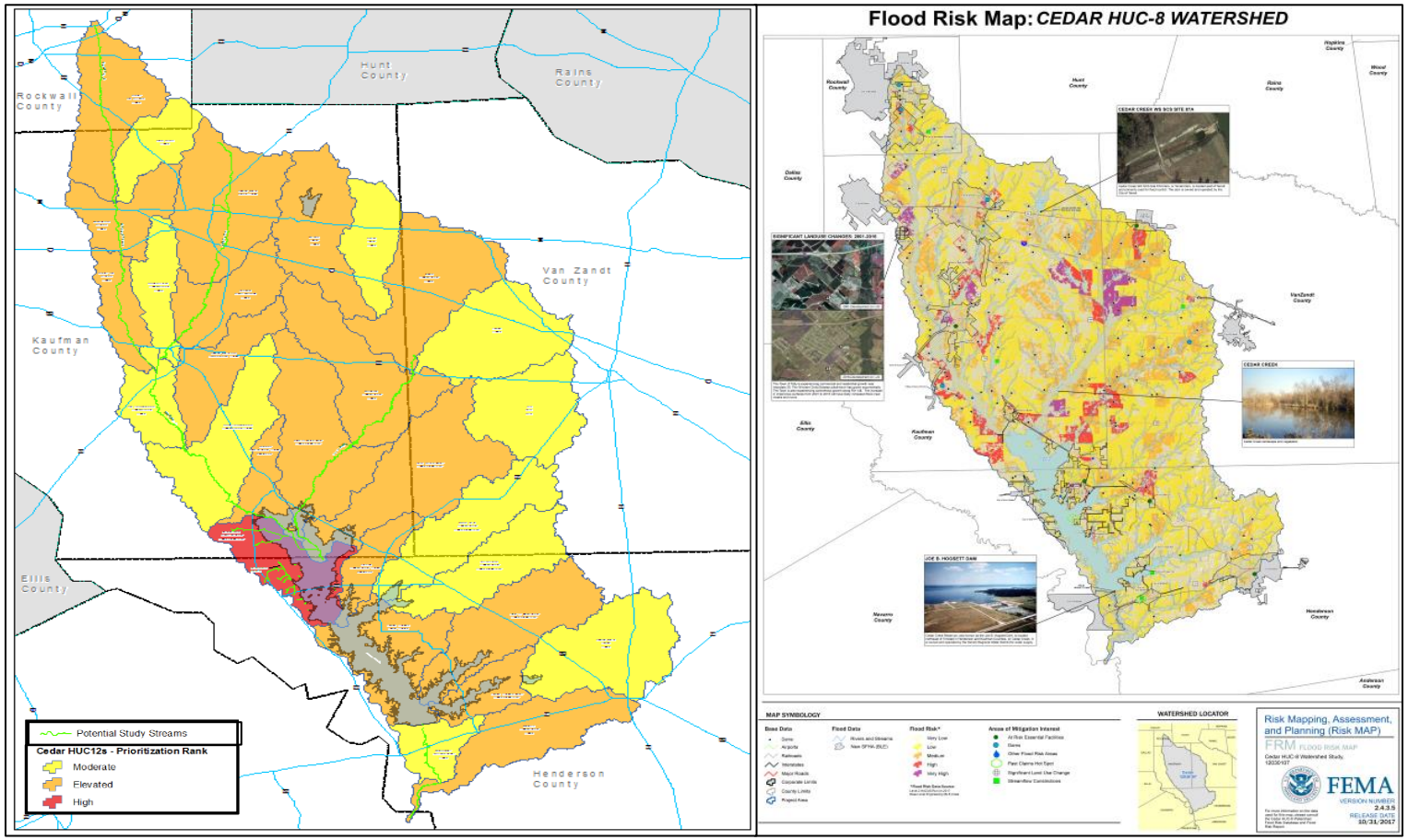
POST-DISCOVERY ACTIONS

- Post-Discovery Actions
  - -Analyze data collected
  - -Review findings with LaDOTD
  - -Preliminary project selections provided to communities
  - -Evaluate community input
  - -Discovery Report
- Findings Meetings – Fall 2022



POST-DISCOVERY RESULTS

- Population density and change
- Predicted population growth
- Historical flood events and claims
- Number of Letters of Map Change (LOMR/LOMA)
- Available current topography
- Age of technical data – hydrology and hydraulics
- Ability to leverage current studies
- Potential for local funding and "work in kind"
- Previous contribution to FEMA studies
- Stakeholder mapping requests



The primary result of Discovery is a list of projects to be considered for funding!

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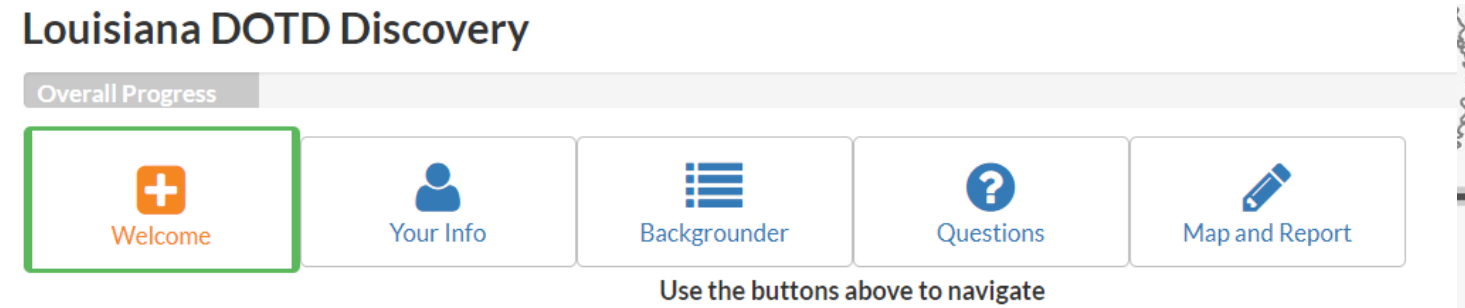
DISCOVERY SUMMARY

- Heighten community involvement and understanding
- Gather all flood-related information available
  - Knowledge of Flood Risks and Past Flooding in your community
  - Hazard Mitigation Projects – ongoing, planned or completed
  - Master Drainage Plans and floodplain studies – ongoing, planned or completed
  - Current flood risk communication process
  - GIS data
- Request needs in the community
  - Questions and concerns for DFIRM maps
  - All questions and concerns for dams and levees
  - Study request in areas of repetitive loss
  - Areas of new development or other causes of concern for the future
  - Funding needs for identified flood risk projects

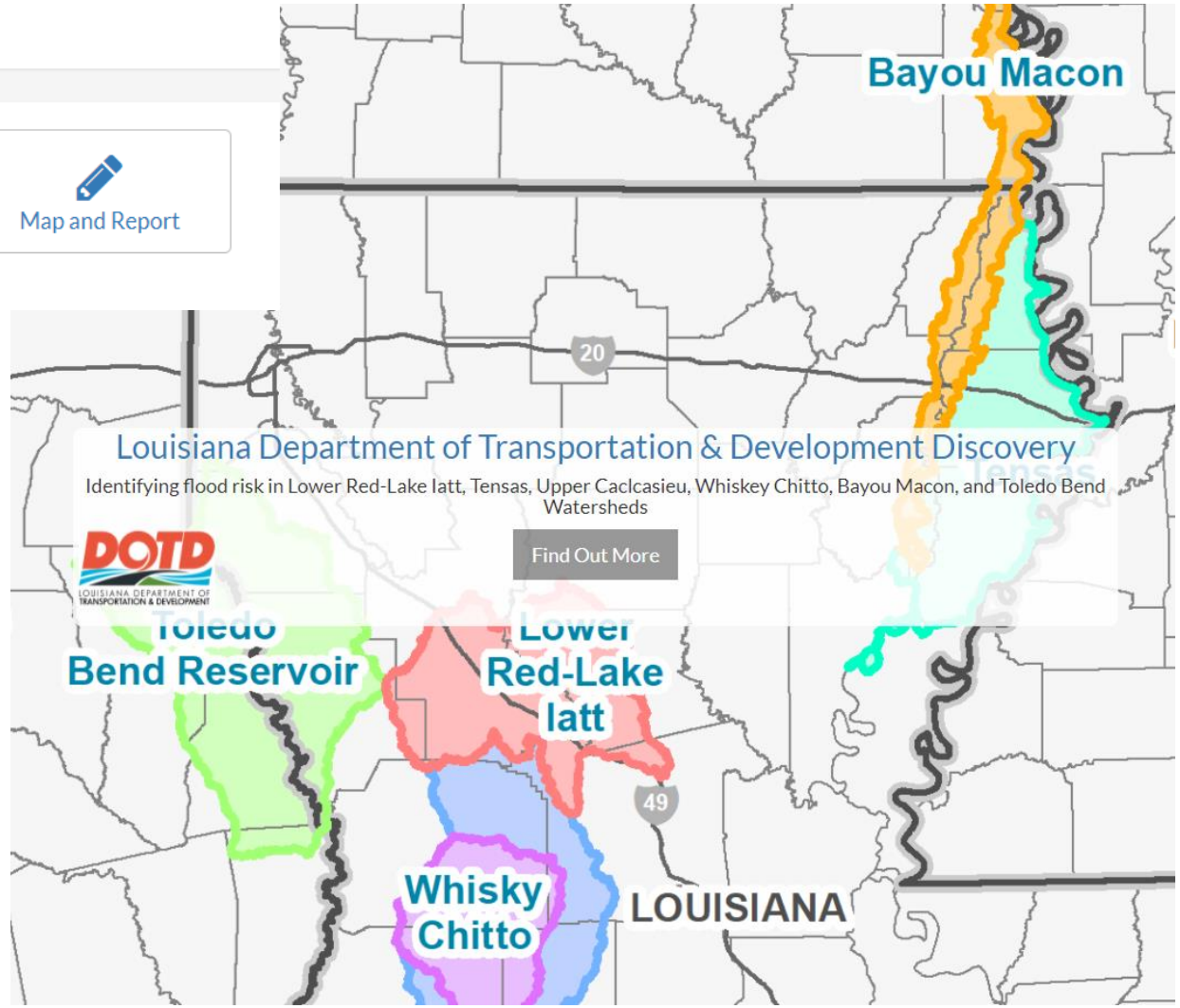
DISCOVERY SUMMARY

- Next steps
  - Involve other people in your office, team and community
  - Go to the website and add all information you gather
  - Call or email with questions
  - Join us in March for the Discovery meeting for any additional conversation
  - Get funding for your area!

PLEASE ENTER YOUR INFORMATION ON THE WEBSITE – LIVE AFTER THIS MEETING



Customize Discovery:
After the meeting, enter your community's data at:
https://dotd.discovery.halff.com
Password: DOTD_FY20!



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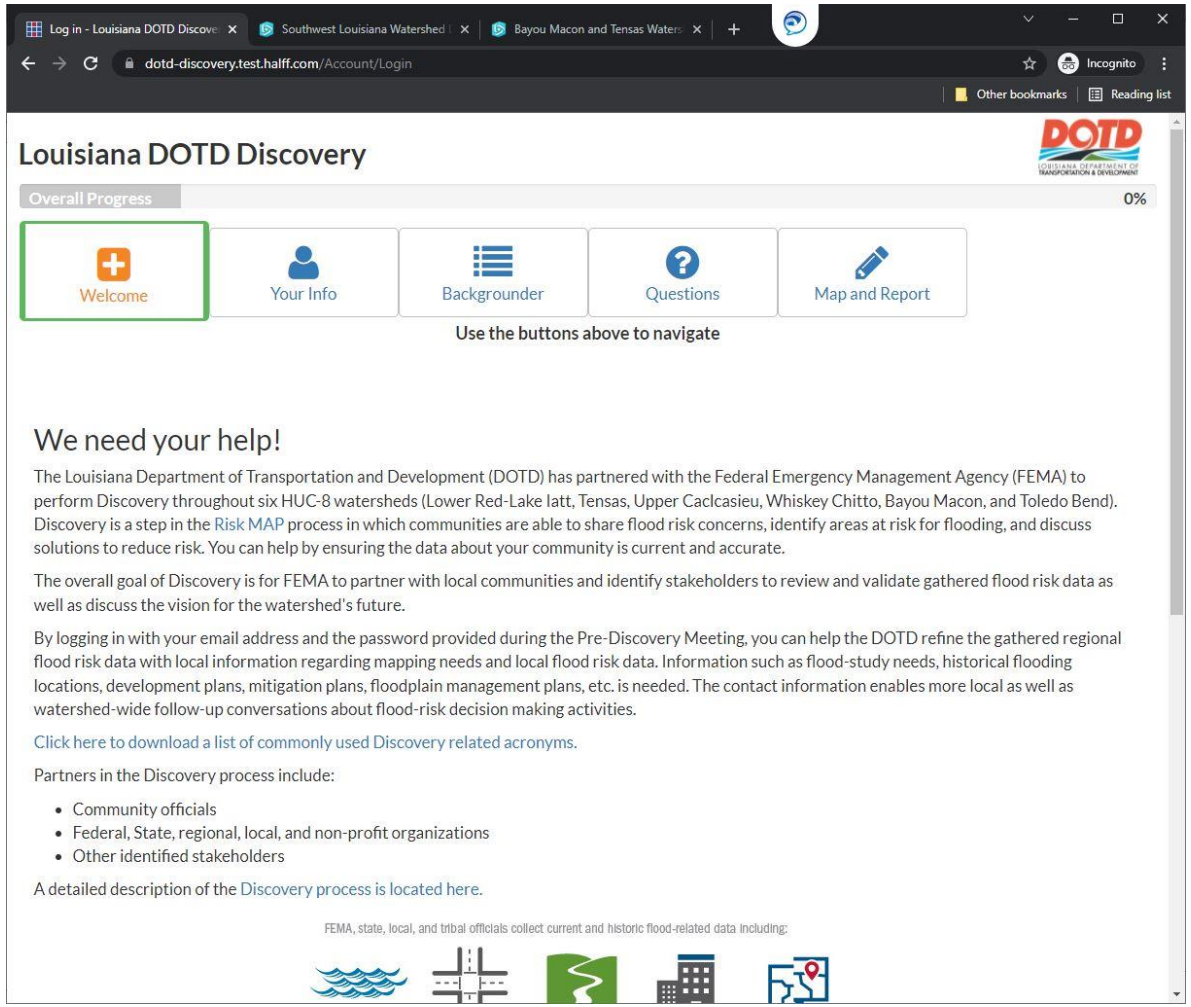
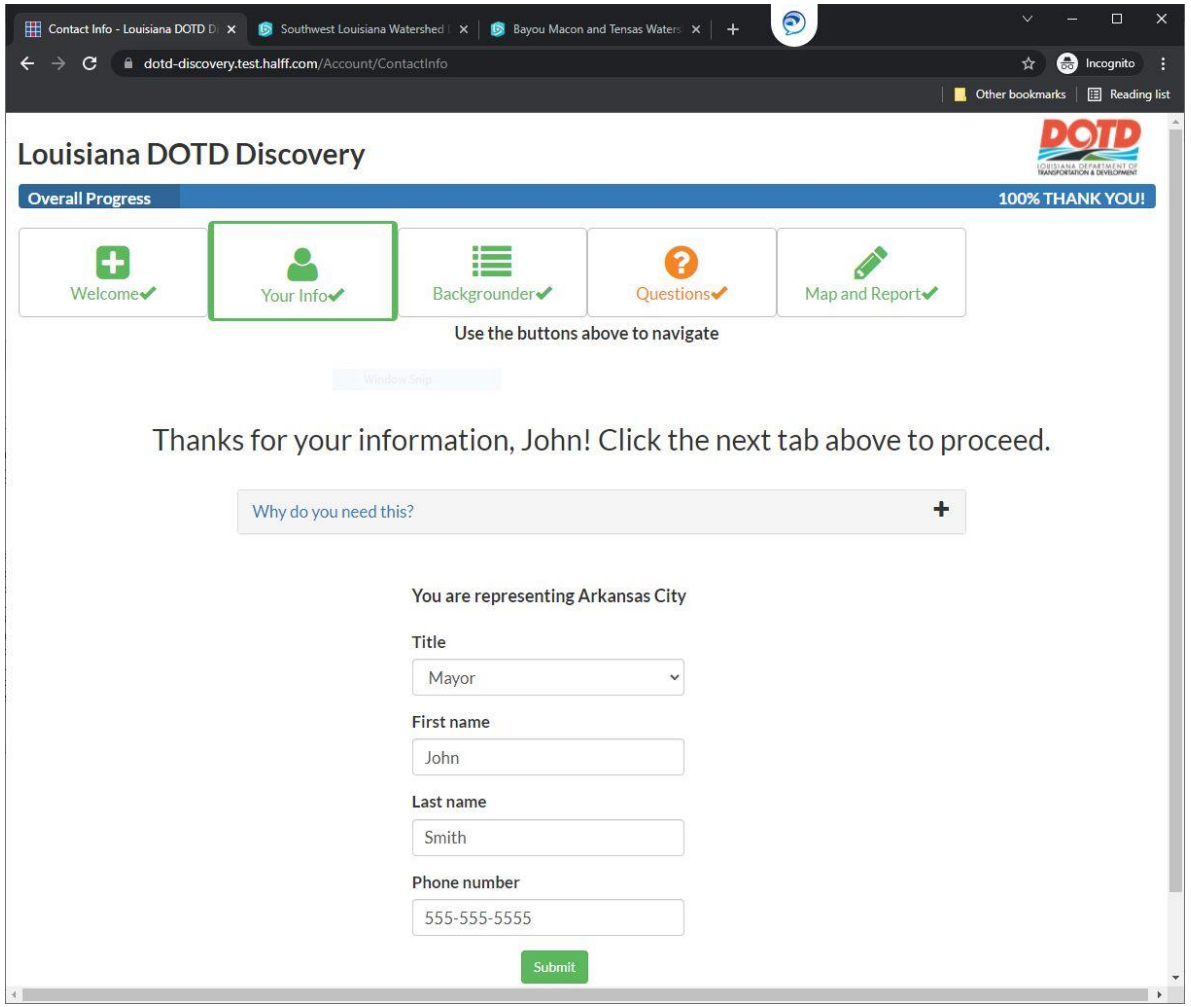
WEBSITE OVERVIEW





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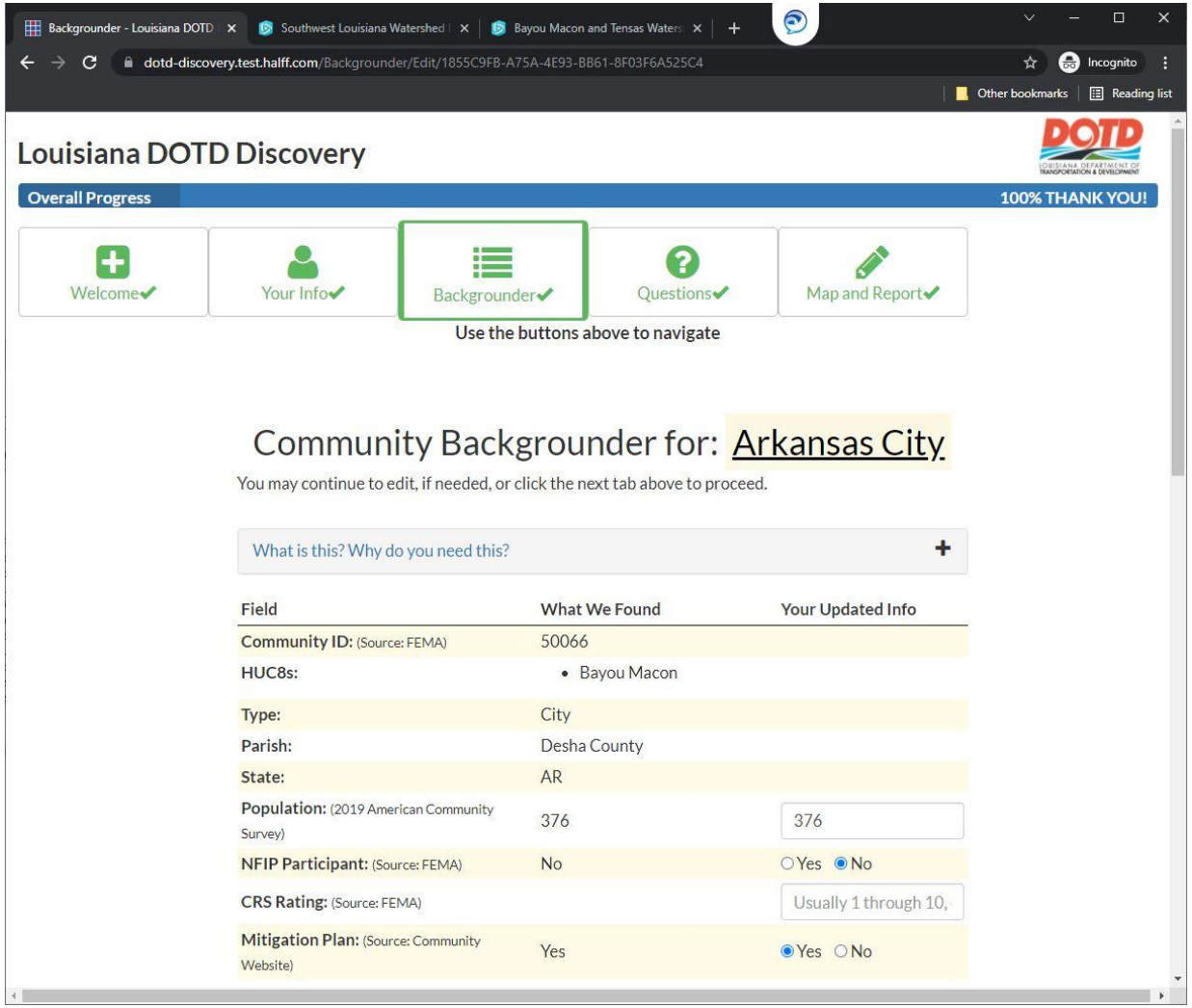
WEBSITE OVERVIEW

Community Backgrounder

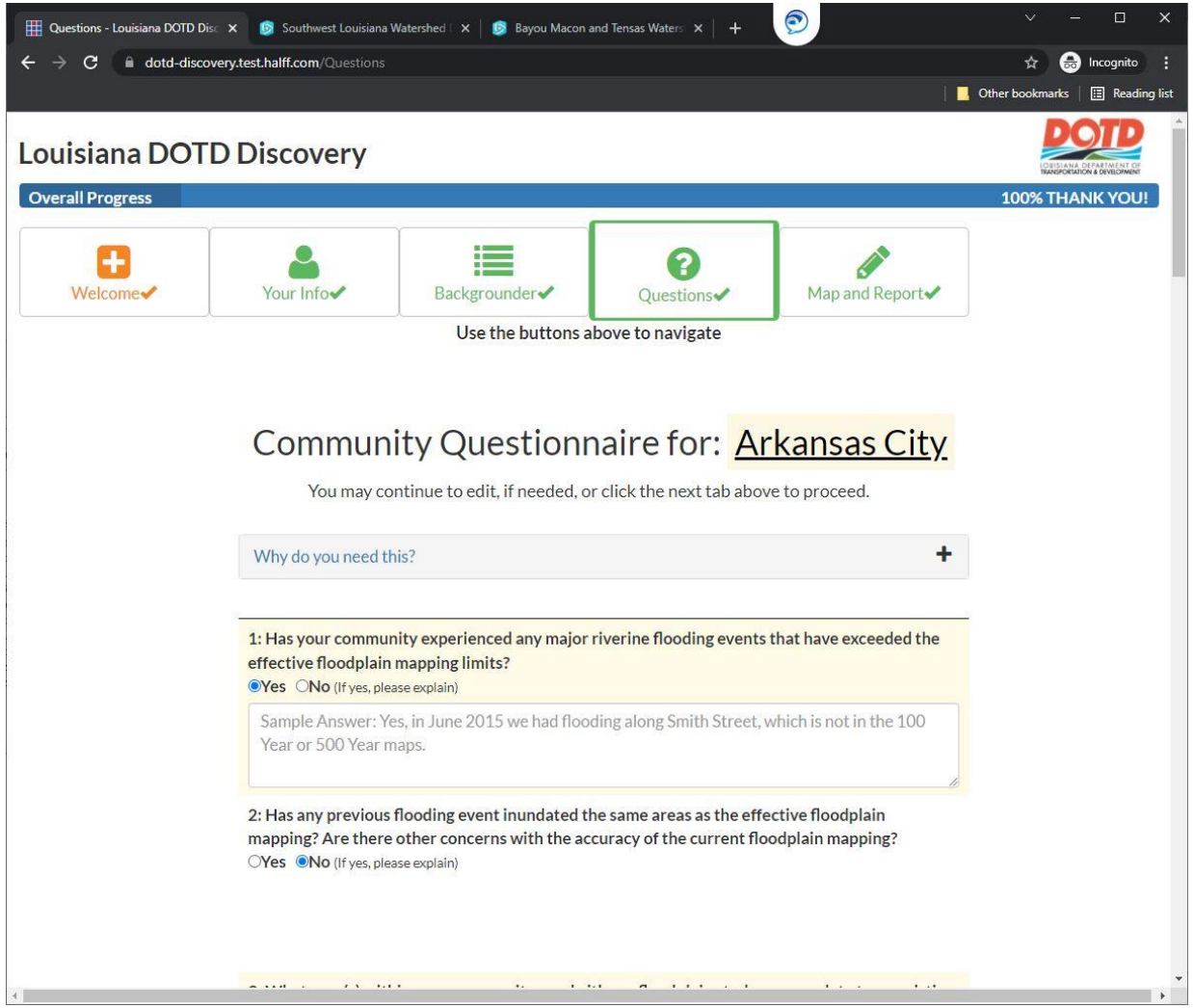
- Snapshot of existing data
- Open for review and verification
  - Key items for verification:
    - Number of NFIP claims
    - Financial cost of losses
    - Mitigation Plan standing (outdated, existing, proposed, etc.)
    - Number of high-water marks
    - Number of low-water crossings



WEBSITE OVERVIEW

Community Questionnaire

- 26 questions to guide flood risk conversation and data gathering/mapping
- Sample responses provided



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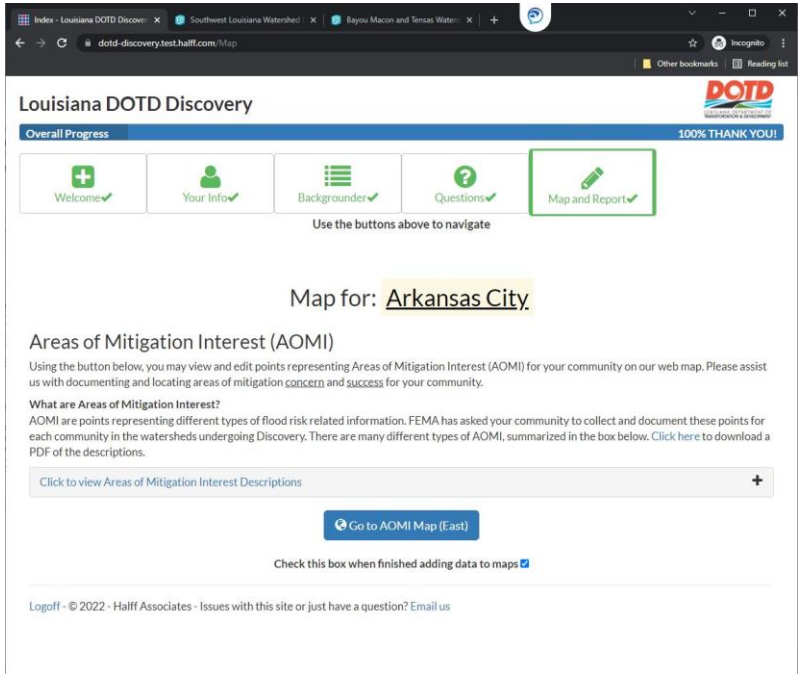

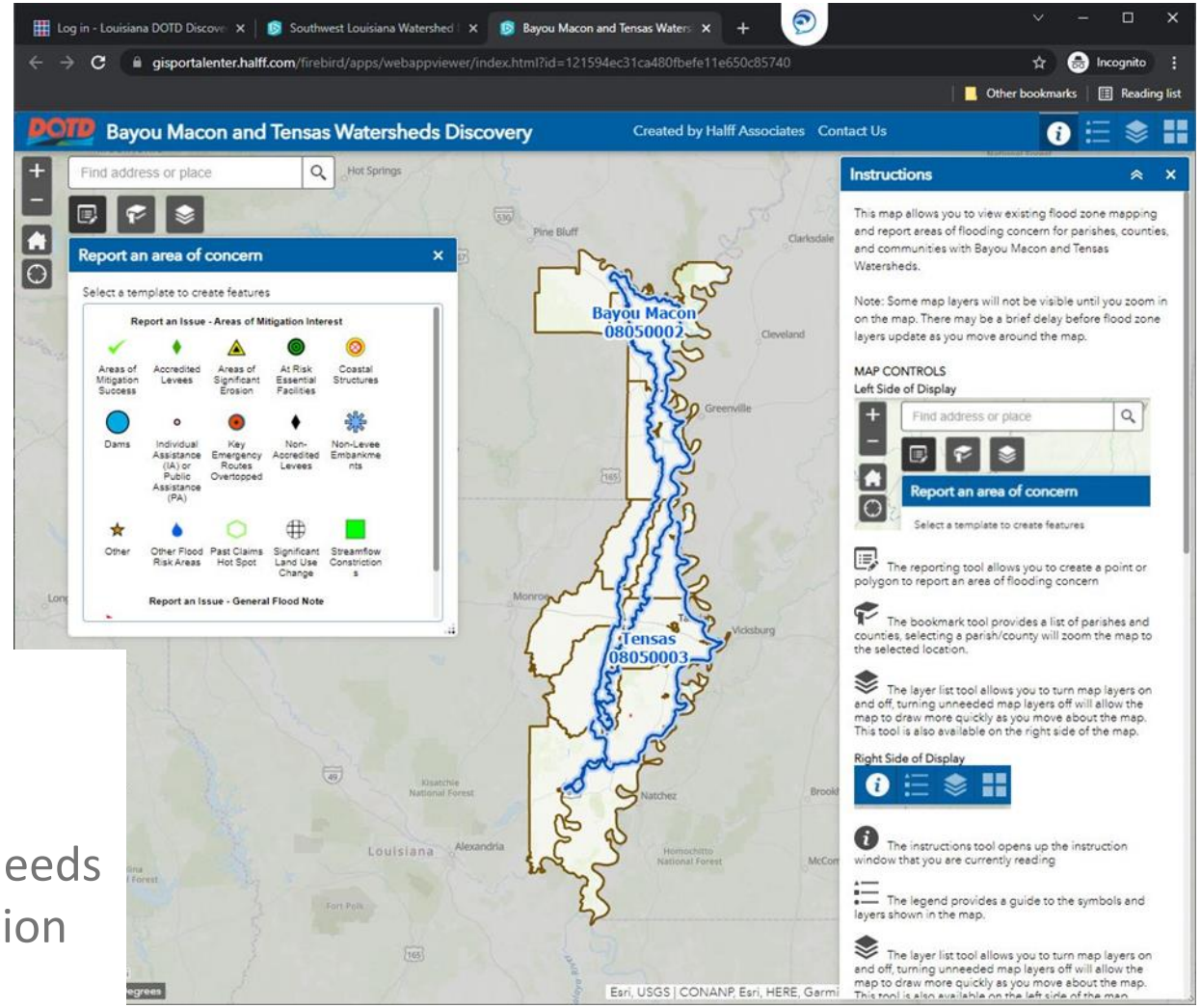

Interactive Webmap

- Areas of Mitigation Interest (AOMI)
- Gathering information on mitigation success and needs
- Place for all additional data and mapping risk location
- Tutorial available online

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QUESTIONS?



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QUESTIONS

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Discovery Findings Webinar Slides

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LOUISIANA DISCOVERY

"CAPTURING A MORE COMPLETE PICTURE OF YOUR WATERSHED"

POST-DISCOVERY MEETING

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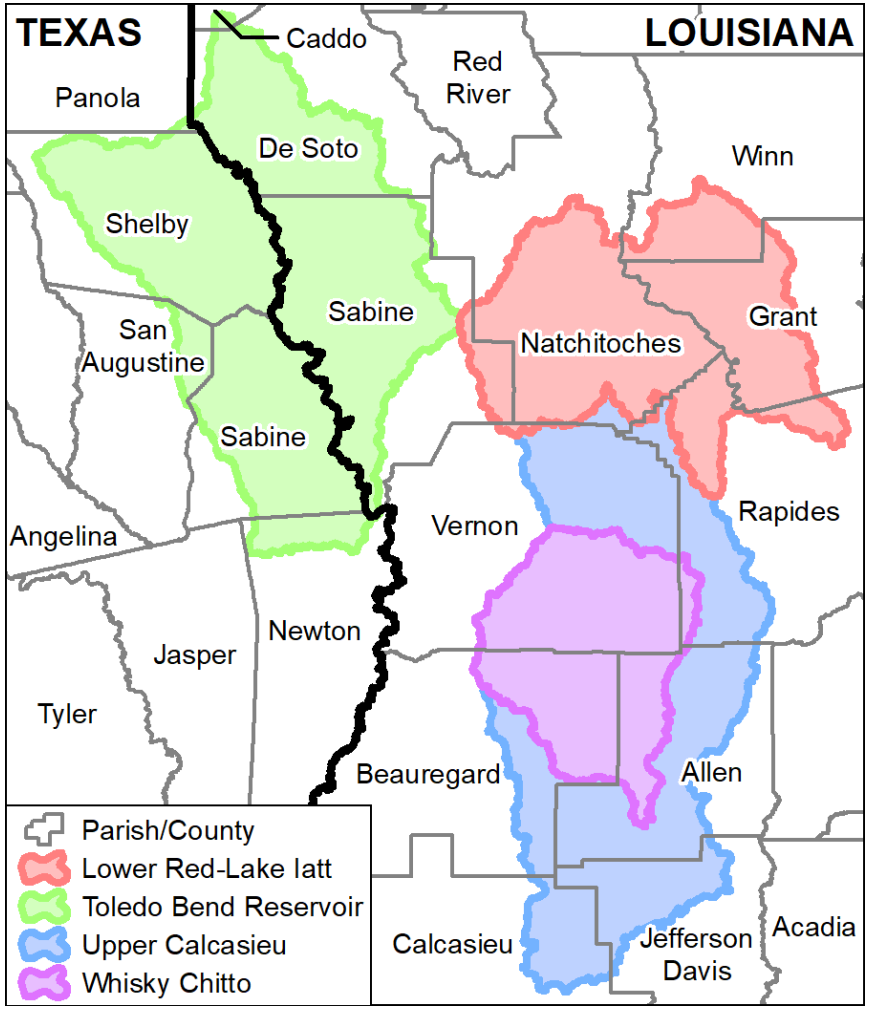
AGENDA

- Discovery Overview
- Overview of Risk MAP
- LaDOTD Discovery Activities
  - Pre-Discovery Activities
  - Discovery Activities
    - Data Gathering Website and Walk-through
  - Post-Discovery Activities
  - Post-Discovery Results
    - Base Level Engineering
    - HAZUS Results
- Post Meeting Coordination
- BFE Overview
- Project Recommendations to FEMA



DISCOVERY OVERVIEW

Discovery is FEMA's process for identifying and accessing flood risk to better prepare a list of needs and projects to address those needs within communities.

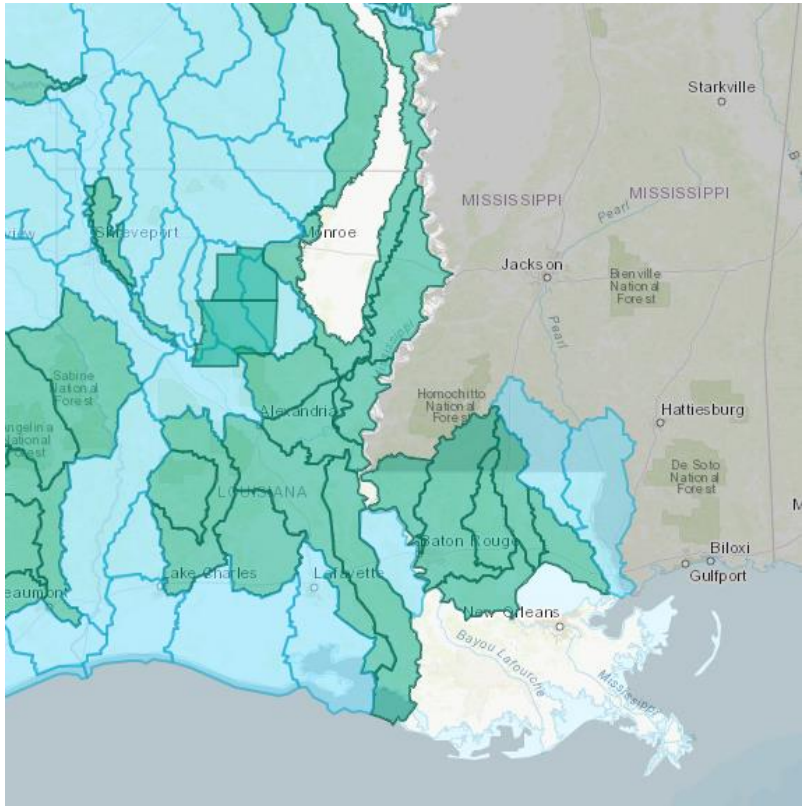
- Heighten community involvement and understanding
- Gather all flood-related information available
  - Knowledge of Flood Risks and Past Flooding in your community
  - Hazard Mitigation Projects – ongoing, planned or completed
  - Master Drainage Plans and floodplain studies – ongoing, planned or completed
  - Current flood risk communication process
  - GIS data

DISCOVERY OVERVIEW

- Request needs in the community
  - Questions and concerns for DFIRM maps
  - All questions and concerns for dams and levees
  - Study request in areas of repetitive loss
  - Areas of new development or other causes of concern for the future
  - Funding needs for identified flood risk projects

- Present Projects for Consideration
  - Modeling and Mapping needs
  - Structural improvements listed in the Flood Risk Map

FEMA'S RISK MAP PROGRAM



- Provide flood information and tools for better **protection**
- **Action-Driven** through local understanding and ownership of risk



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LOUISIANA DOTD DISCOVERY GOALS

Louisiana Watersheds Discovery

- Goals
  - Inform Community of Present Flood Risk
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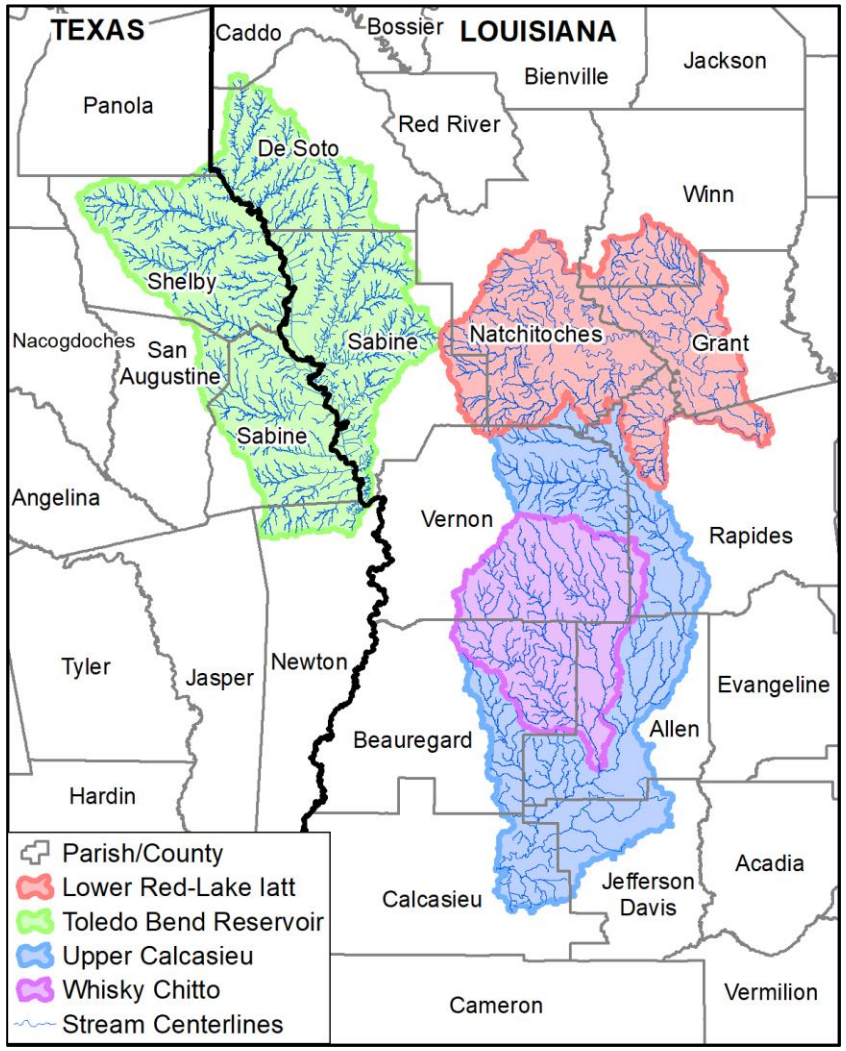

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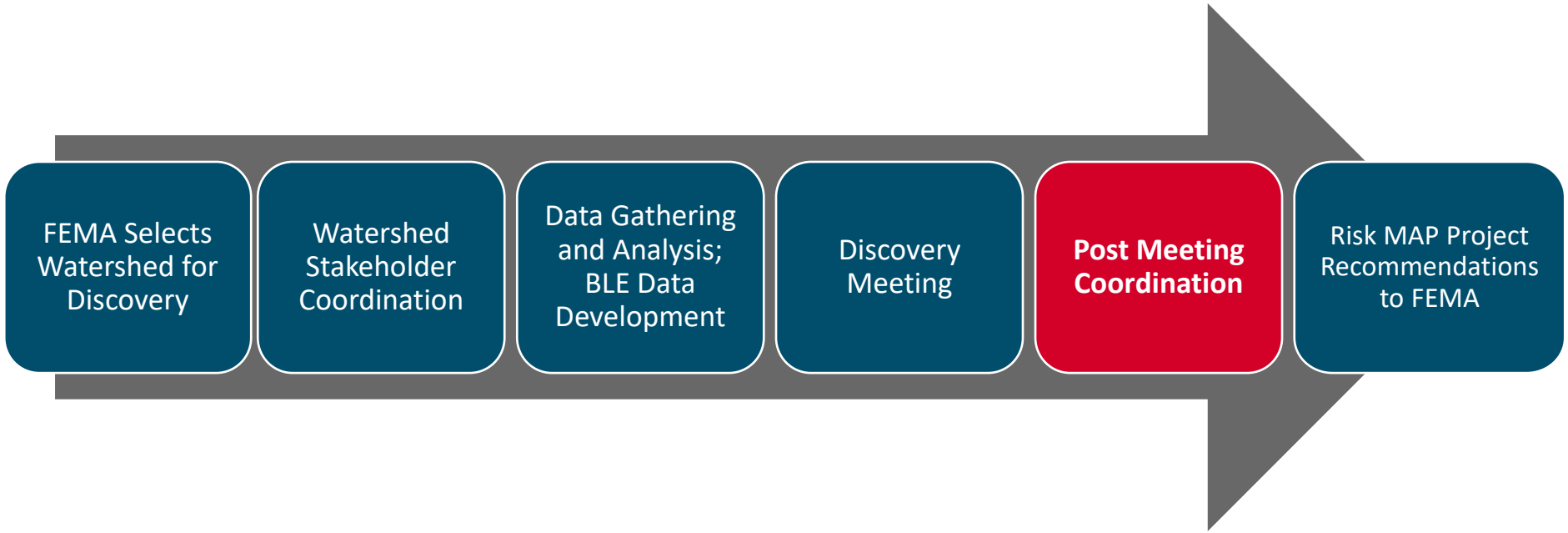
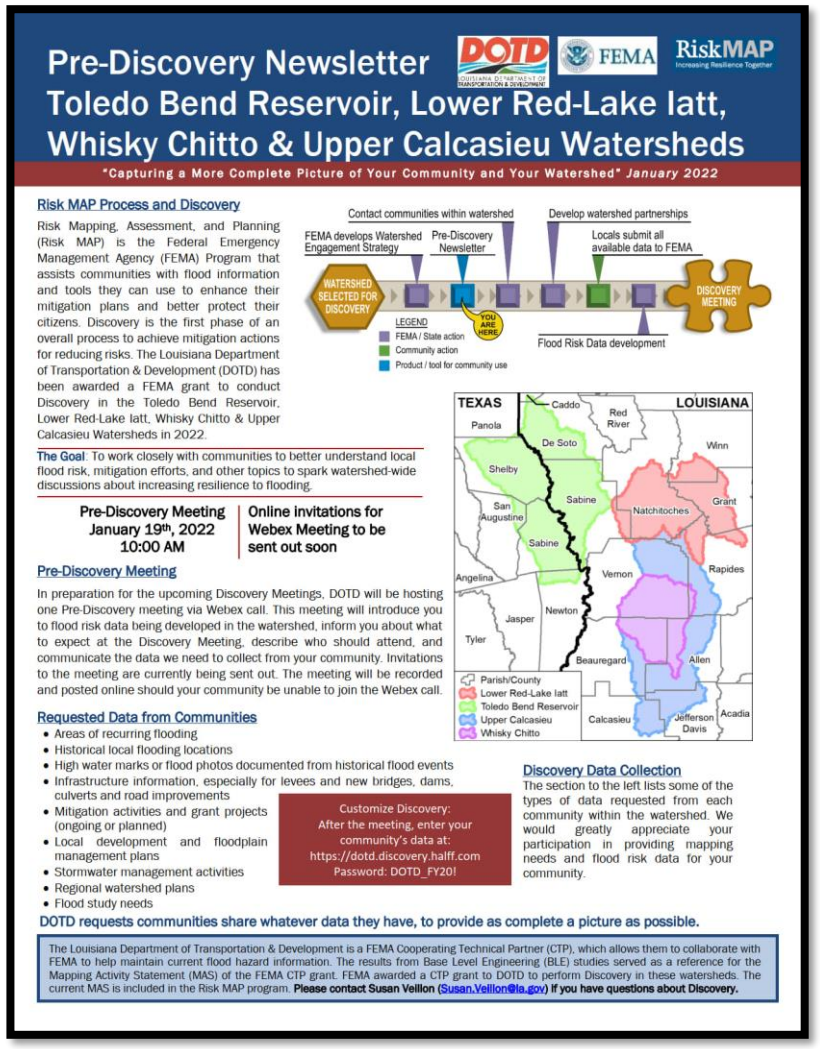
DISCOVERY STEPS

- ***Capture a more complete picture of your watershed by working closely with local communities…***



DISCOVERY NEWSLETTER



Pre-Discovery Newsletter
Toledo Bend Reservoir, Lower Red-Lake Iatt, Whisky Chitto & Upper Calcasieu Watersheds

Capturing a More Complete Picture of Your Community and Your Watershed January 2022

Risk MAP Process and Discovery

Risk Mapping, Assessment, and Planning (Risk MAP) is the Federal Emergency Management Agency (FEMA) Program that assists communities with flood information and tools they can use to enhance their mitigation plans and better protect their citizens. Discovery is the first phase of an overall process to achieve mitigation actions for reducing risks. The Louisiana Department of Transportation & Development (DOTD) has been awarded a FEMA grant to conduct Discovery in the Toledo Bend Reservoir, Lower Red-Lake Iatt, Whisky Chitto & Upper Calcasieu Watersheds in 2022.

Contact communities within watershed
Develop watershed partnerships
FEMA develops Watershed Engagement Strategy
Pre-Discovery Newsletter
Locals submit all available data to FEMA
WATERSHED SELECTED FOR DISCOVERY
DISCOVERY MEETING
LEGEND
FEMA / State action
Community action
Product / tool for community use
YOU ARE HERE
Flood Risk Data development

The Goal: To work closely with communities to better understand local flood risk, mitigation efforts, and other topics to spark watershed-wide discussions about increasing resilience to flooding.

Pre-Discovery Meeting
January 19th, 2022
10:00 AM

Online invitations for Webex Meeting to be sent out soon

Pre-Discovery Meeting

In preparation for the upcoming Discovery Meetings, DOTD will be hosting one Pre-Discovery meeting via Webex call. This meeting will introduce you to flood risk data being developed in the watershed, inform you about what to expect at the Discovery Meeting, describe who should attend, and communicate the data we need to collect from your community. Invitations to the meeting are currently being sent out. The meeting will be recorded and posted online should your community be unable to join the Webex call.

Requested Data from Communities

- Areas of recurring flooding
- Historical local flooding locations
- High water marks or flood photos documented from historical flood events
- Infrastructure information, especially for levees and new bridges, dams, culverts and road improvements
- Mitigation activities and grant projects (ongoing or planned)
- Local development and floodplain management plans
- Stormwater management activities
- Regional watershed plans
- Flood study needs

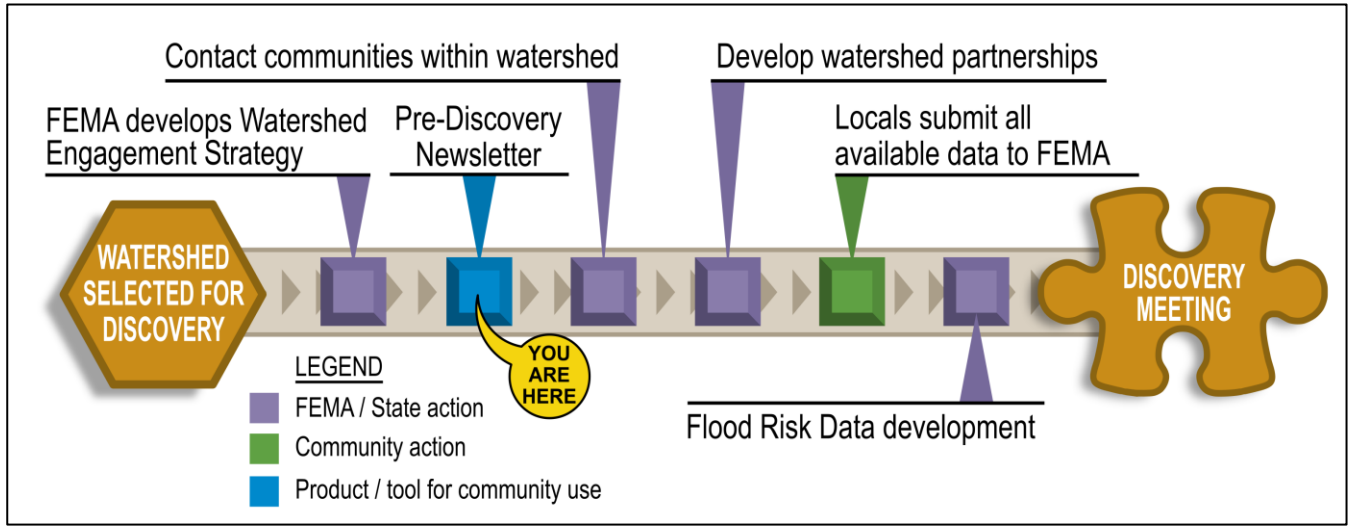
Customize Discovery:
After the meeting, enter your community's data at:
https://dotd.discovery.halff.com
Password: DOTD_FY20!

Discovery Data Collection

The section to the left lists some of the types of data requested from each community within the watershed. We would greatly appreciate your participation in providing mapping needs and flood risk data for your community.

DOTD requests communities share whatever data they have, to provide as complete a picture as possible.

The Louisiana Department of Transportation & Development is a FEMA Cooperating Technical Partner (CTP), which allows them to collaborate with FEMA to help maintain current flood hazard information. The results from Base Level Engineering (BLE) studies served as a reference for the Mapping Activity Statement (MAS) of the FEMA CTP grant. FEMA awarded a CTP grant to DOTD to perform Discovery in these watersheds. The current MAS is included in the Risk MAP program. **Please contact Susan Veillon (Susan.Veillon@la.gov) if you have questions about Discovery.**



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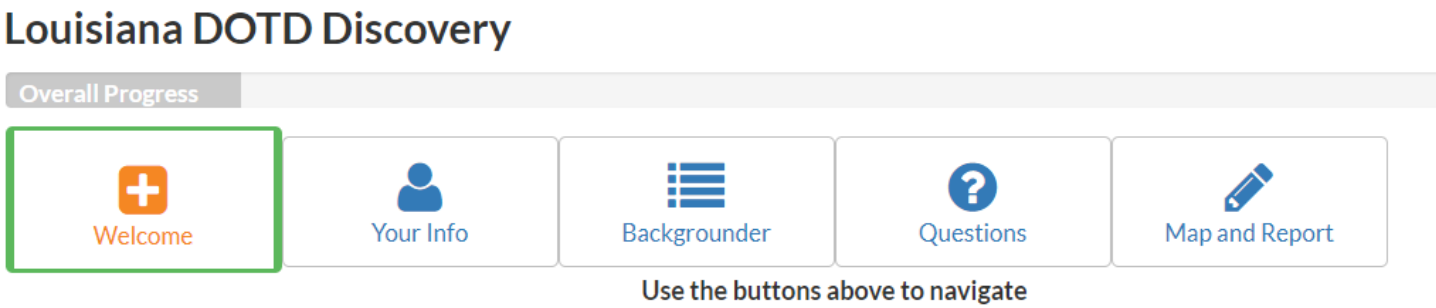
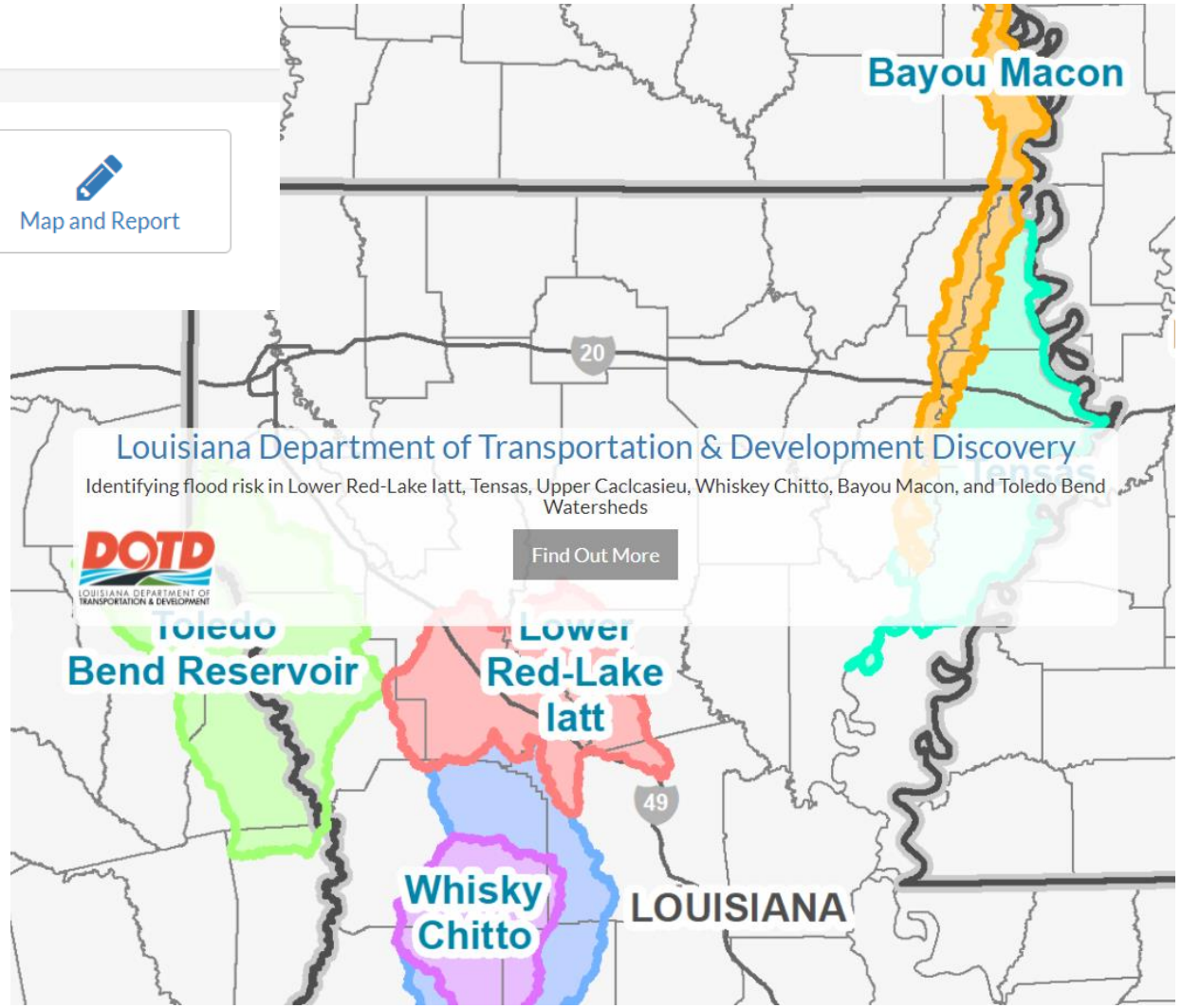
DISCOVERY MEETINGS – WEBSITE



- Enter your communities' data online
- Discovery meetings were conducted in March
- All community stakeholders were encouraged to attend



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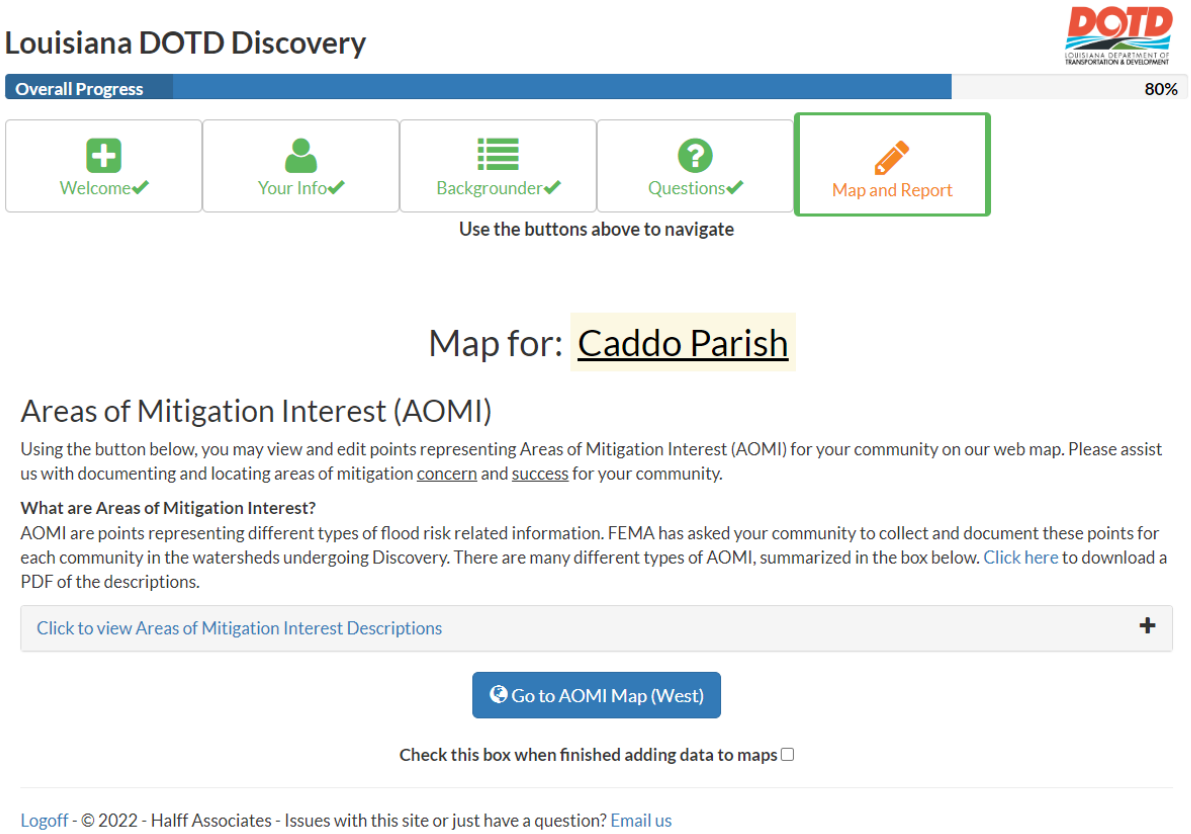
DISCOVERY ACTIVITIES - WEBSITE

Community Backgrounder

- Key items for verification:
  - Number of NFIP claims
  - Financial cost of losses
  - Mitigation Plan standing (outdated, existing, proposed, etc.)
  - Number of high-water marks
  - Number of low-water crossings
  - Significant Land Use Changes
  - Issues with Effective Mapping



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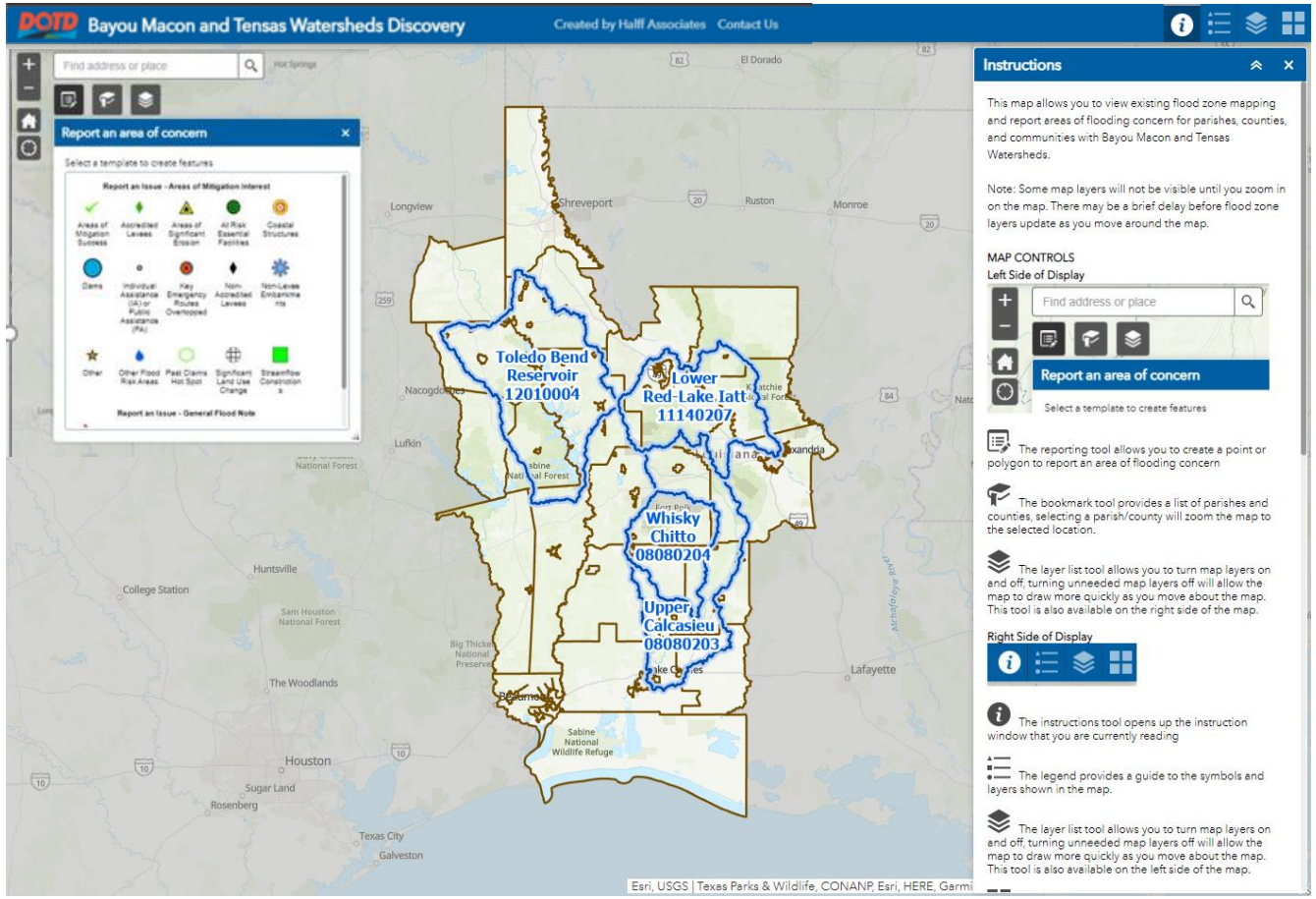
DISCOVERY ACTIVITIES - WEBSITE

Interactive Webmap

- Areas of Mitigation Interest (AOMI)
- Gathering information on at risk facilities, significant erosion areas, past claim hotspots, low water crossings, streamflow constrictions, and other flood risk areas
- Place for all additional data and mapping risk location



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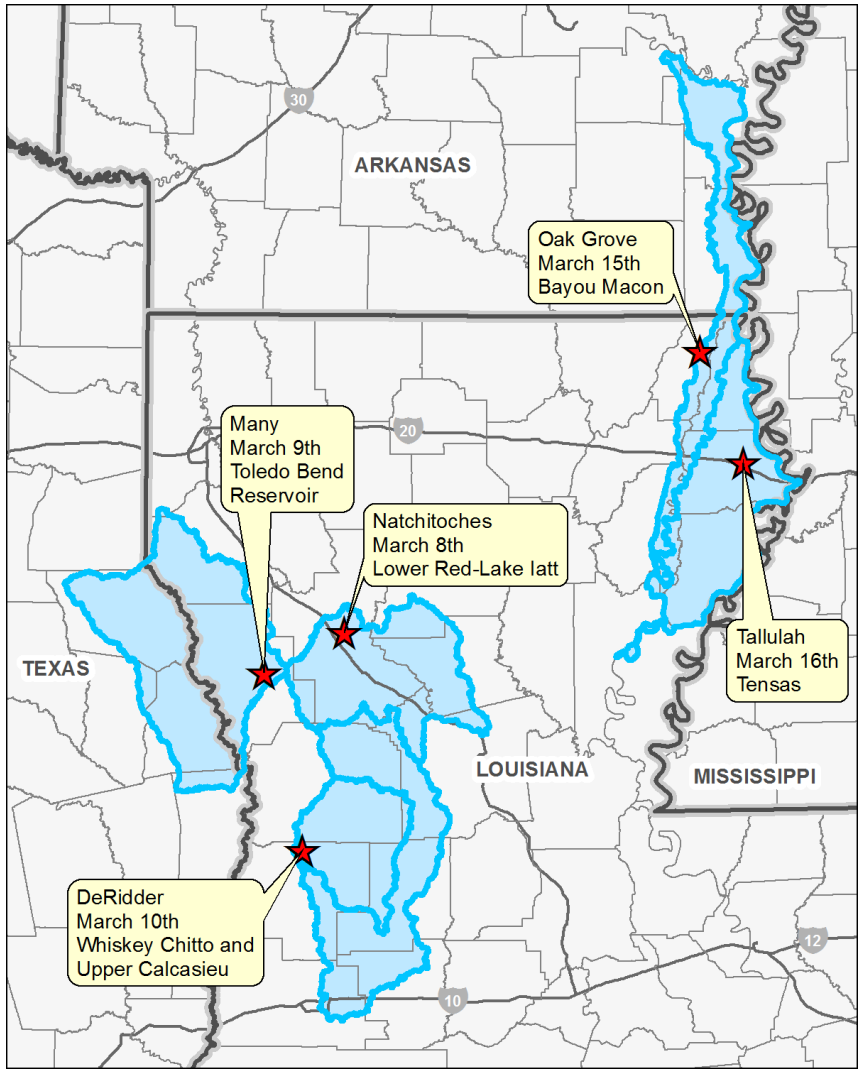
DISCOVERY ACTIVITIES – MEETINGS

- Southwest Watersheds
  - March 8th – Natchitoches
  - March 9th – Many
  - March 10th – DeRidder
- Northeast Watersheds
  - March 15th – Oak Grove
  - March 16th – Tallulah



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DISCOVERY MEETINGS – WHAT TO EXPECT

- "Come and Go" format
- Open conversation
- Served as additional meeting point beyond the webmap
- Facilitated discussion among stakeholders
- Received flooding issues
- Groups present:
  - Federal, State, and Regional Agencies
  - Community Officials and other local stakeholders









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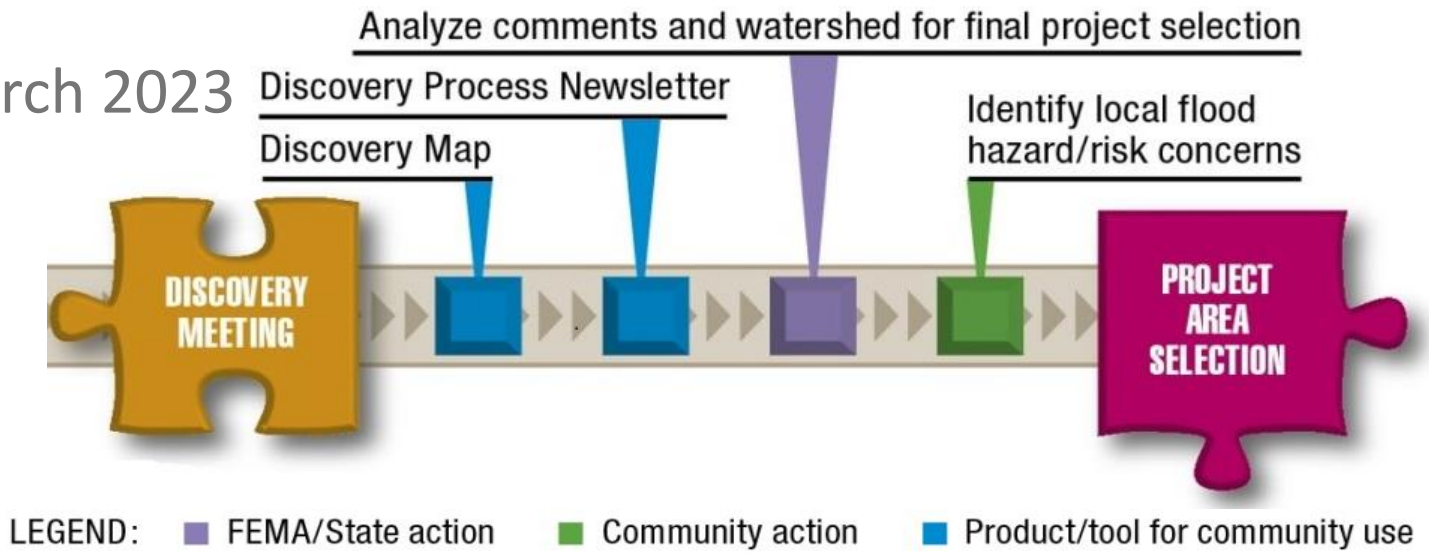
POST-DISCOVERY ACTIONS

- Post-Discovery Actions
  -Analyze data collected
  -Review findings with LaDOTD
  -Preliminary project selections provided to communities
  -Evaluate community input
  -Discovery Report
- Post Discovery Meeting – March 2023

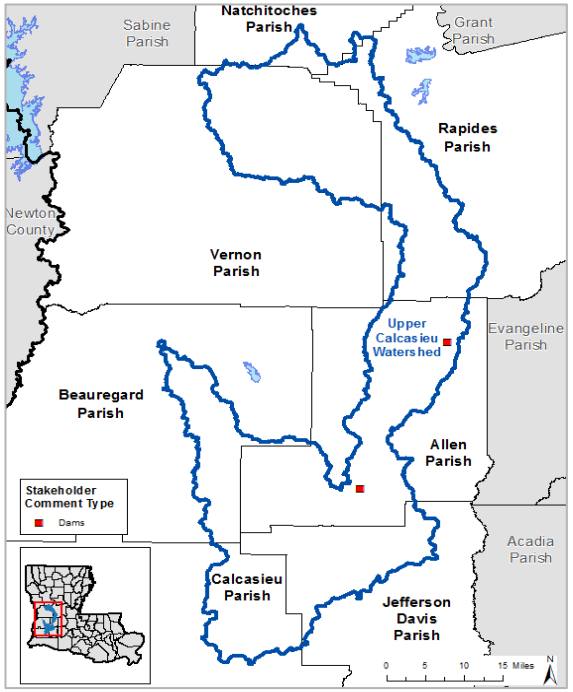


FINDINGS

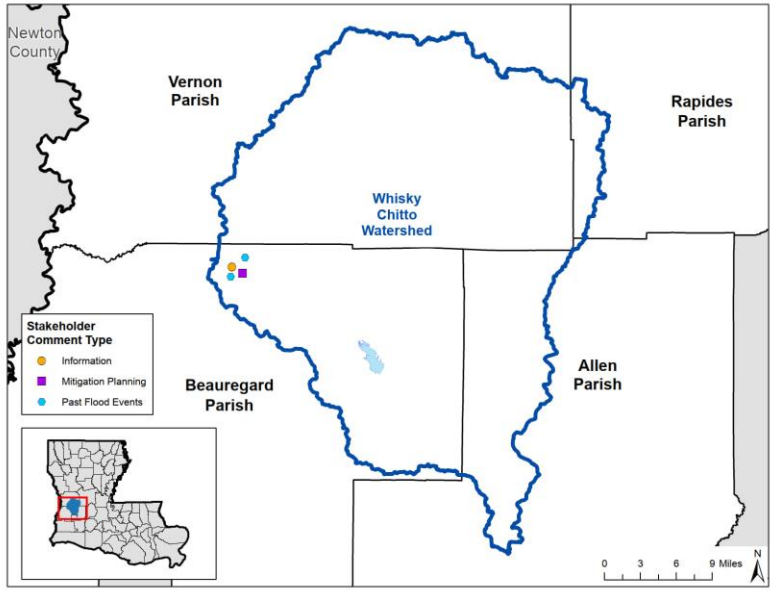
27 STAKEHOLDER MAP COMMENTS

Number of Comments	Community
5	Allen
6	Beauregard
6	Calcasieu
0	Jefferson Davis
0	Natchitoches
5	Rapides
5	Vernon

Upper Calcasieu Watershed



Whisky Chitto Watershed



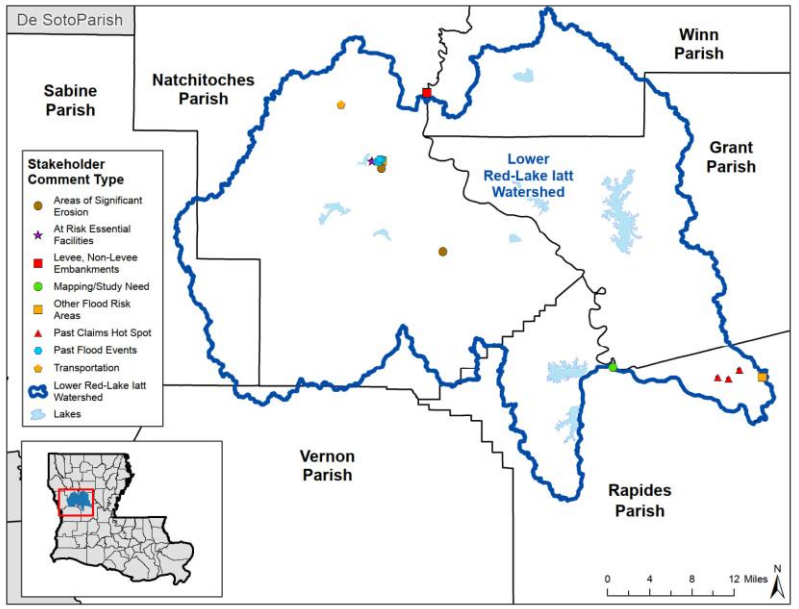
The primary result of Discovery is a list of projects to be considered for funding!

FINDINGS

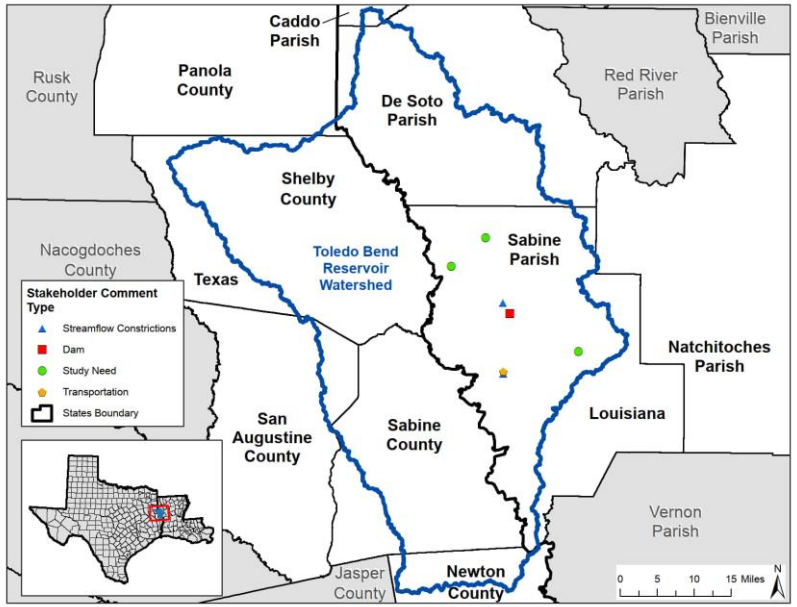
STAKEHOLDER MAP COMMENTS

Number of Comments	Community
0	Caddo
1	DeSoto
3	Grant
10	Natchitoches
14	Rapides
13	Sabine
0	Vernon
1	Winn

Lower Red – Lake Iatt Watershed



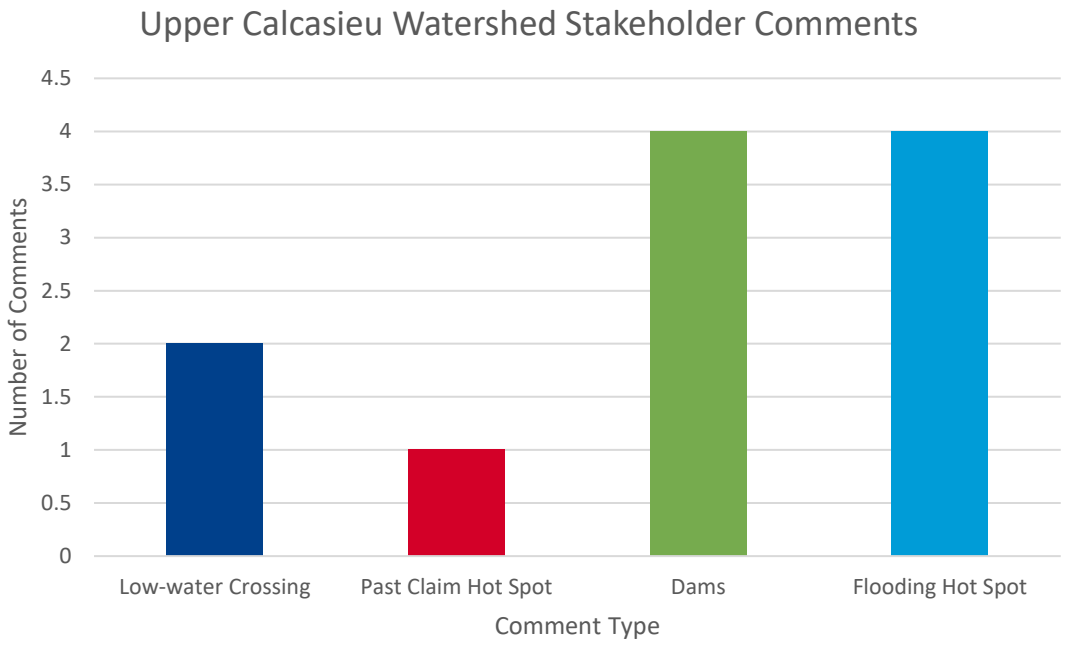
Toledo Bend Reservoir Watershed

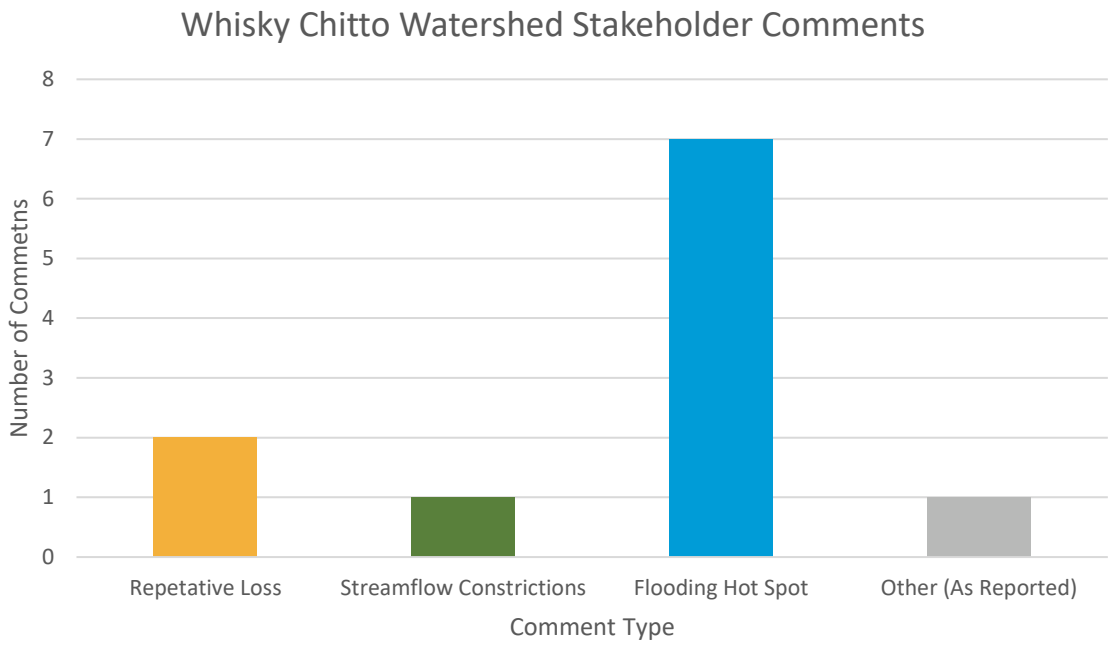


The primary result of Discovery is a list of projects to be considered for funding!

POST-DISCOVERY RESULTS

STAKEHOLDER COMMENTS BY TYPE





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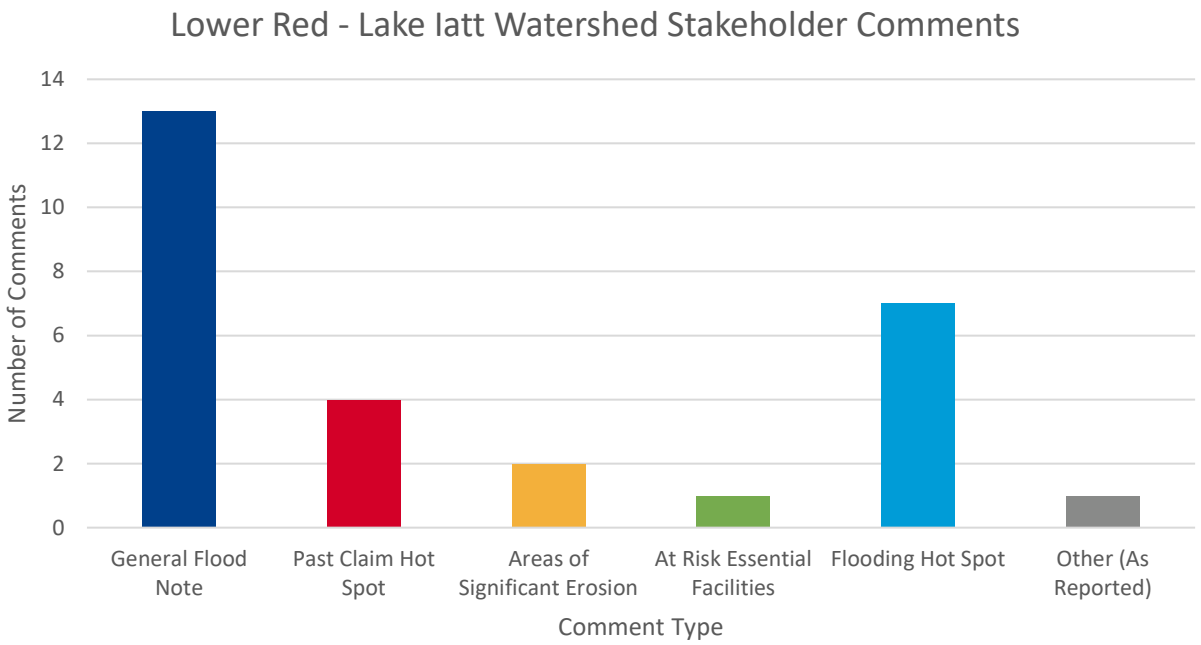
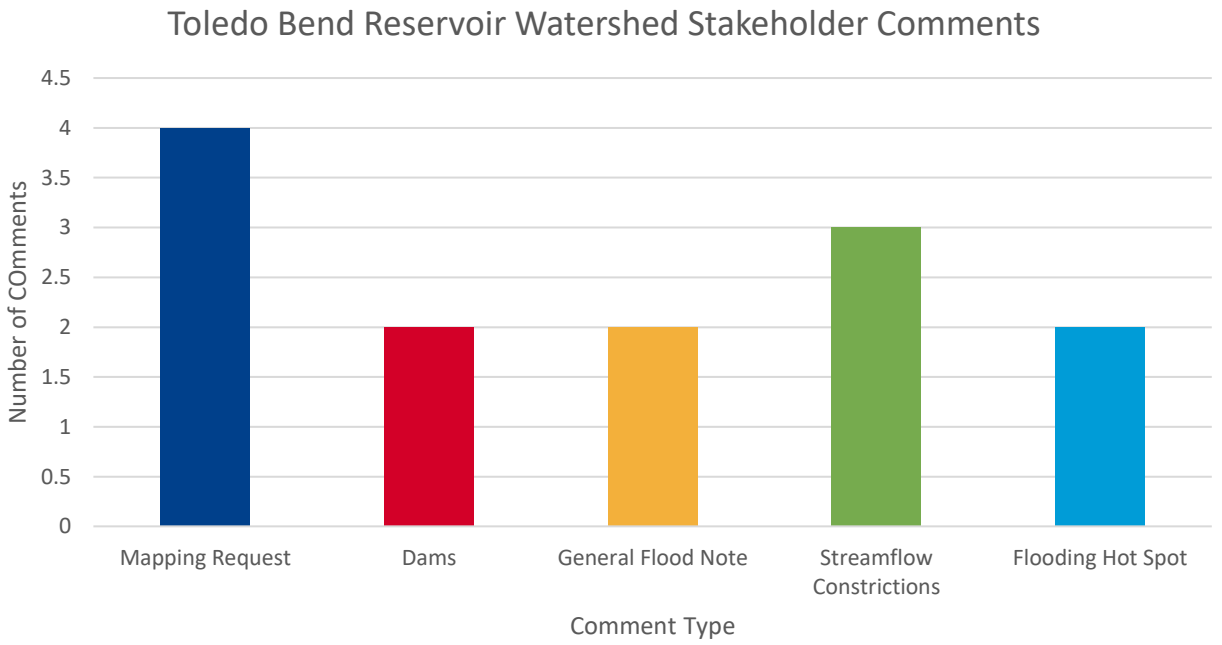
POST-DISCOVERY RESULTS

STAKEHOLDER COMMENTS BY TYPE





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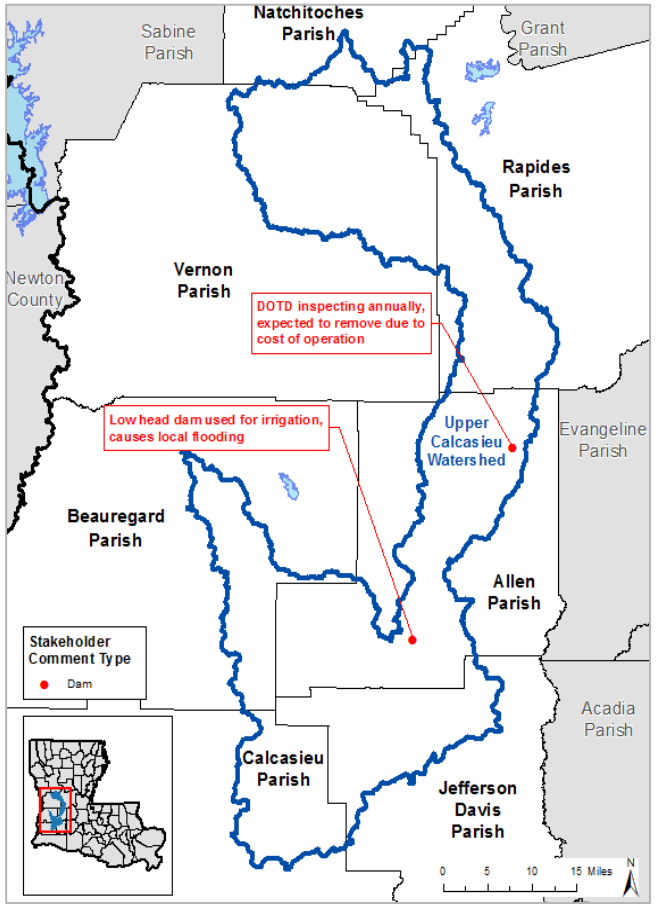
POST-DISCOVERY RESULTS

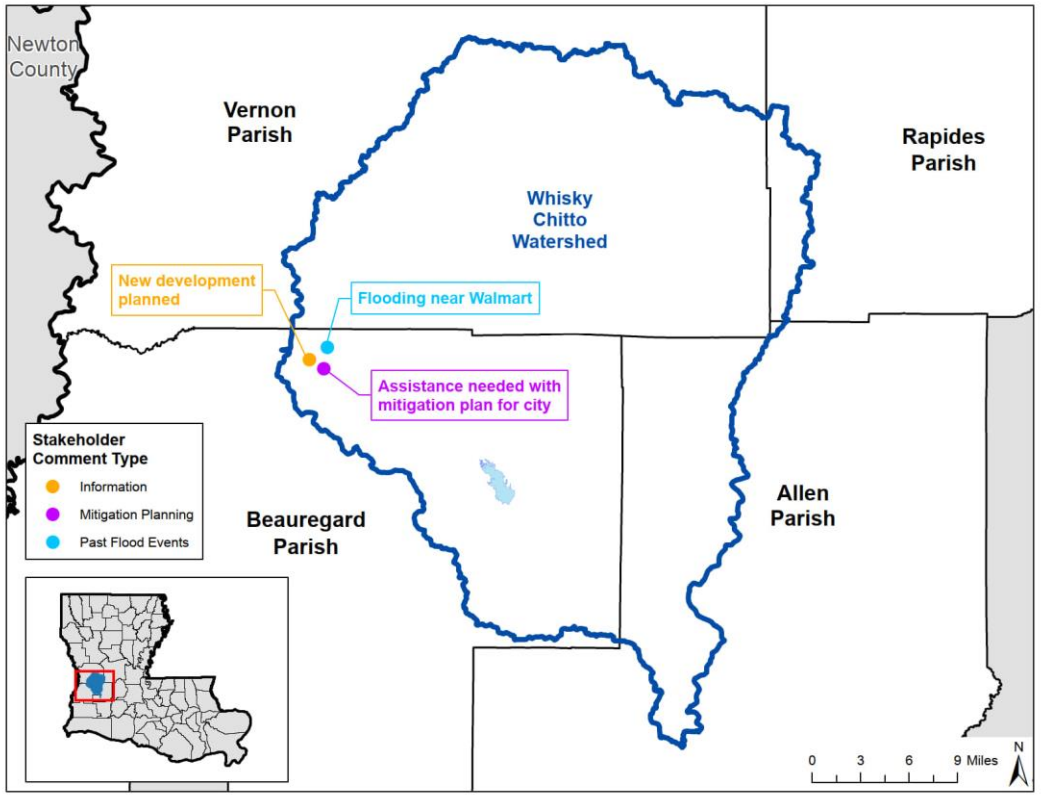
SAMPLE COMMENTS SUBMITTED

Upper Calcasieu Watershed



SAMPLE COMMENTS SUBMITTED

Whiskey Chitto Watershed



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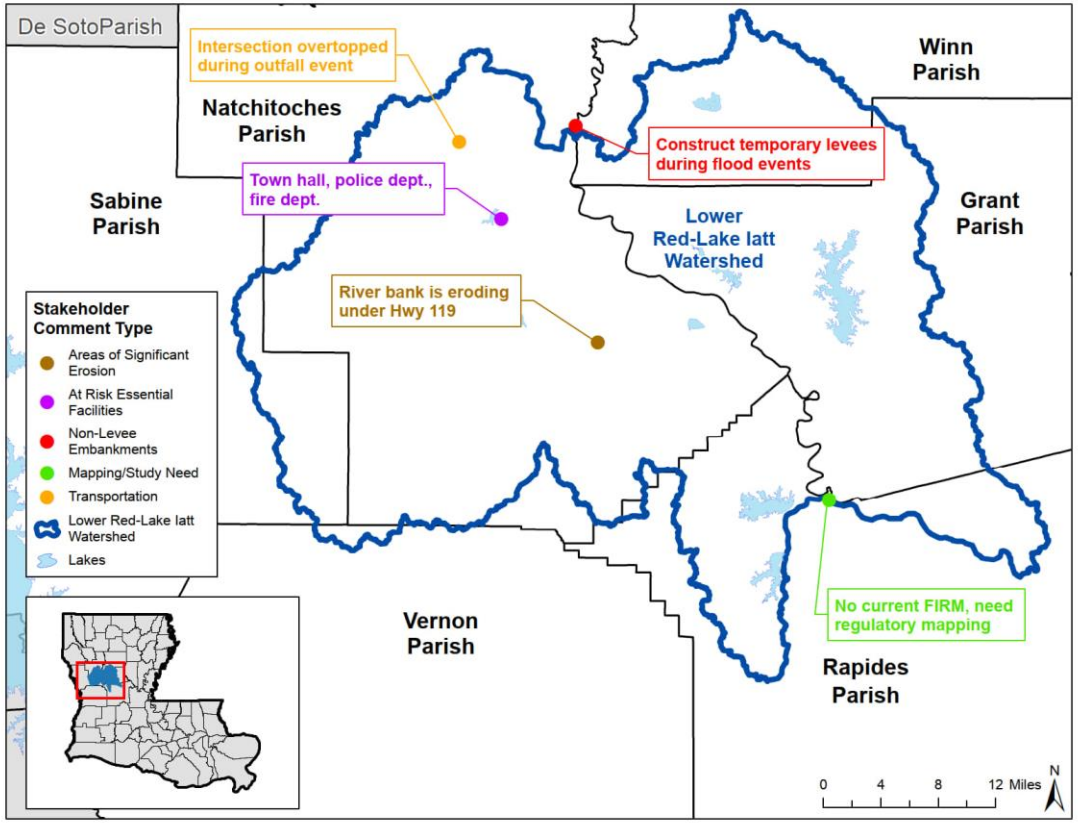
POST-DISCOVERY RESULTS

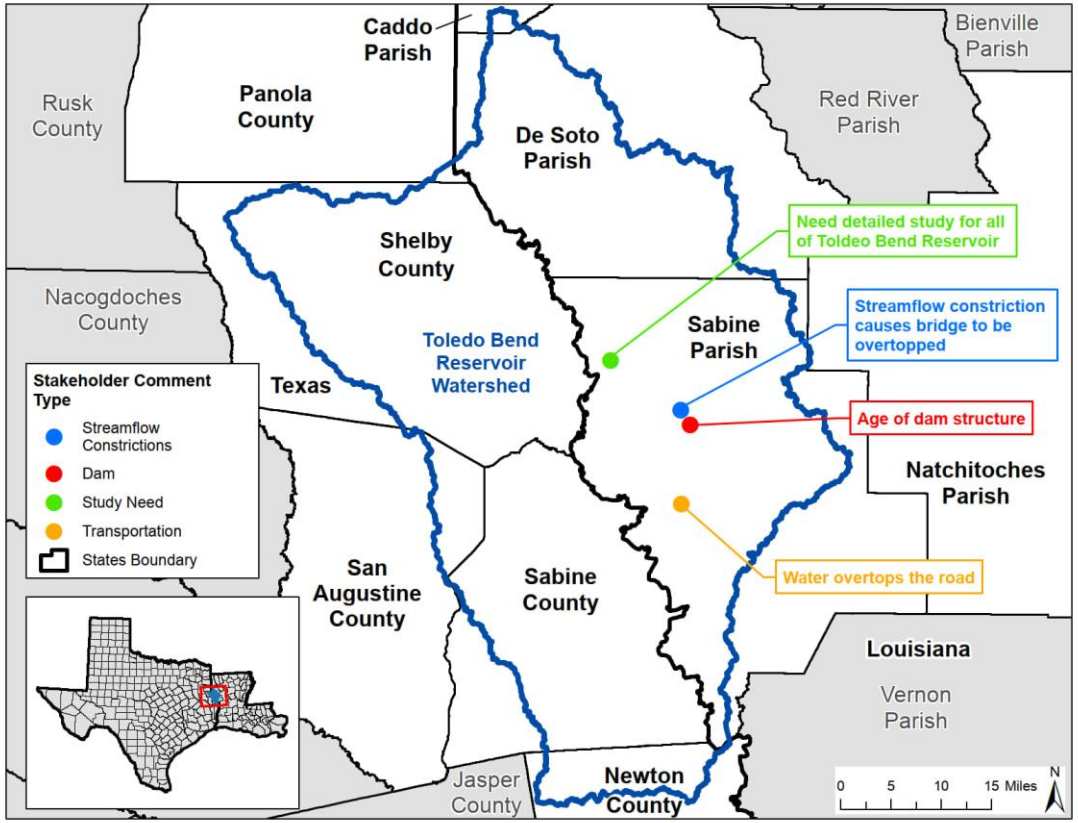
SAMPLE COMMENTS SUBMITTED

Lower Red – Lake Iatt Watershed



SAMPLE COMMENTS SUBMITTED

Toledo Bend Reservoir Watershed



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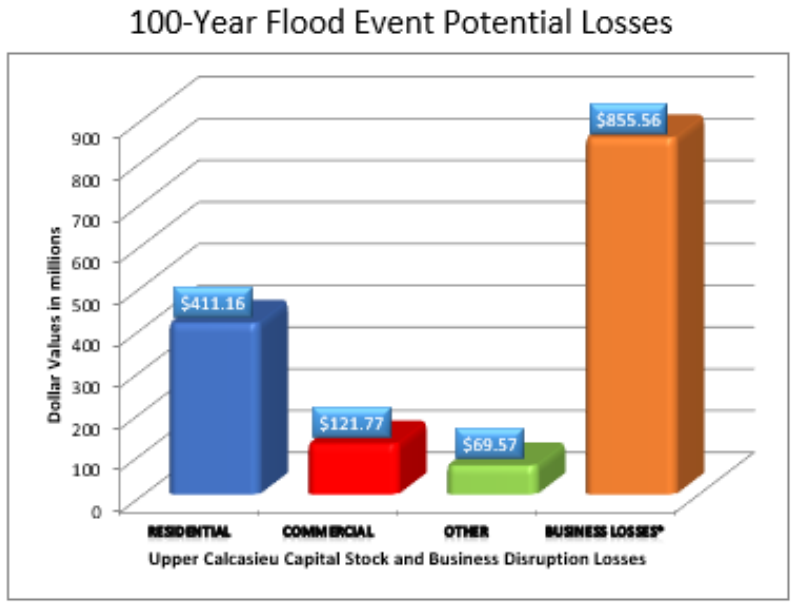
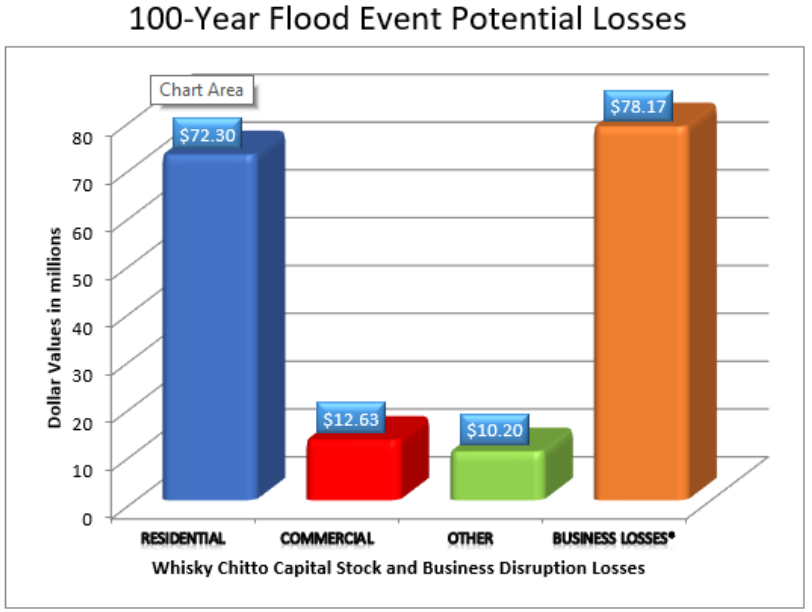
POST-DISCOVERY RESULTS

HAZUS-BASED 100-YEAR POTENTIAL LOSS ESTIMATES

- Identify flooding consequences in damages and other losses
- Based on 100 Year Depth Grids and at-risk assets
- Can be further refined



***Business Losses** are the sum of inventory Loss, Relocation Cost, Income Loss, Rental Income Loss, and Wage Loss.



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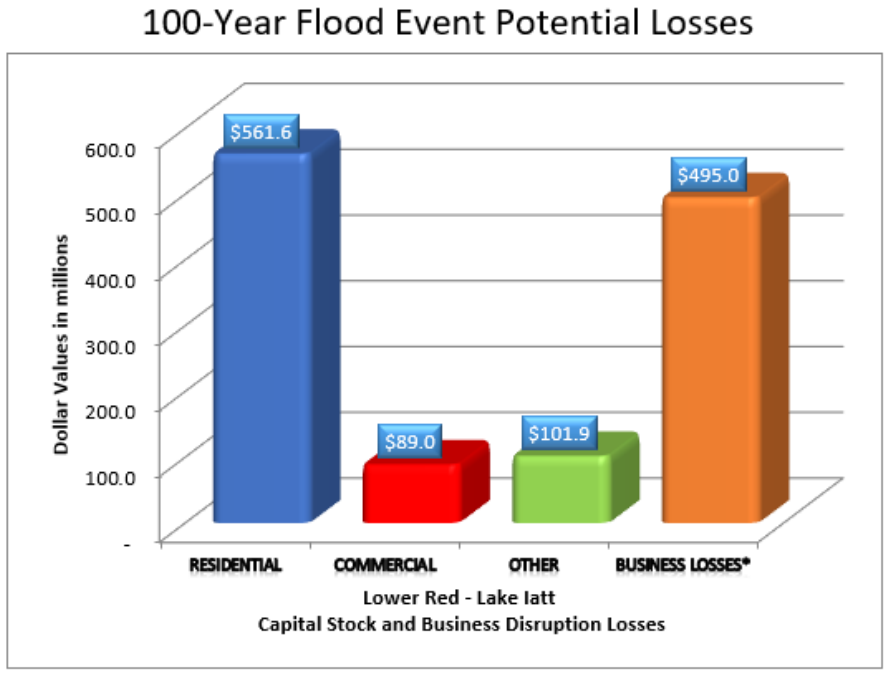
POST-DISCOVERY RESULTS

HAZUS-BASED 100-YEAR POTENTIAL LOSS ESTIMATES



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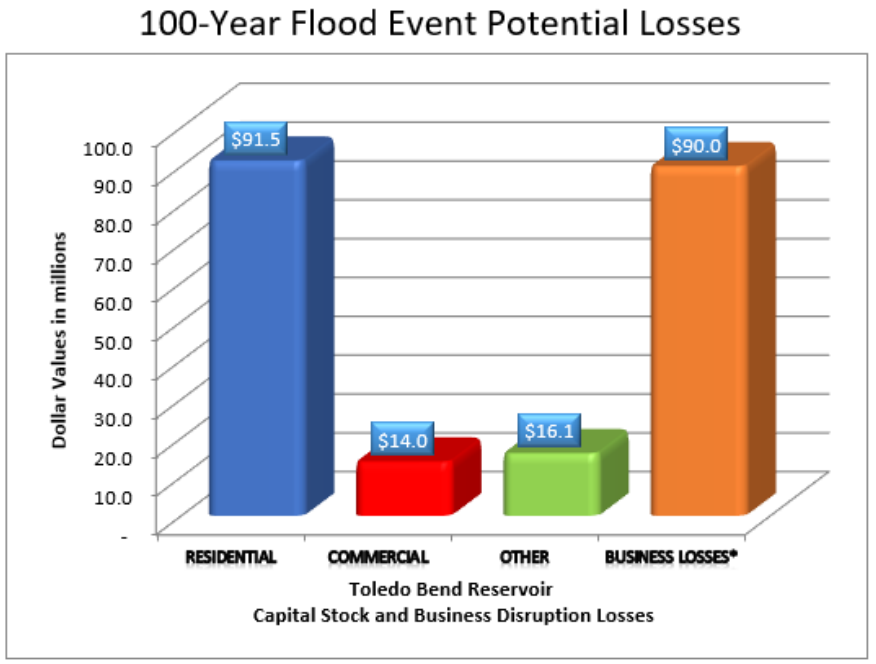

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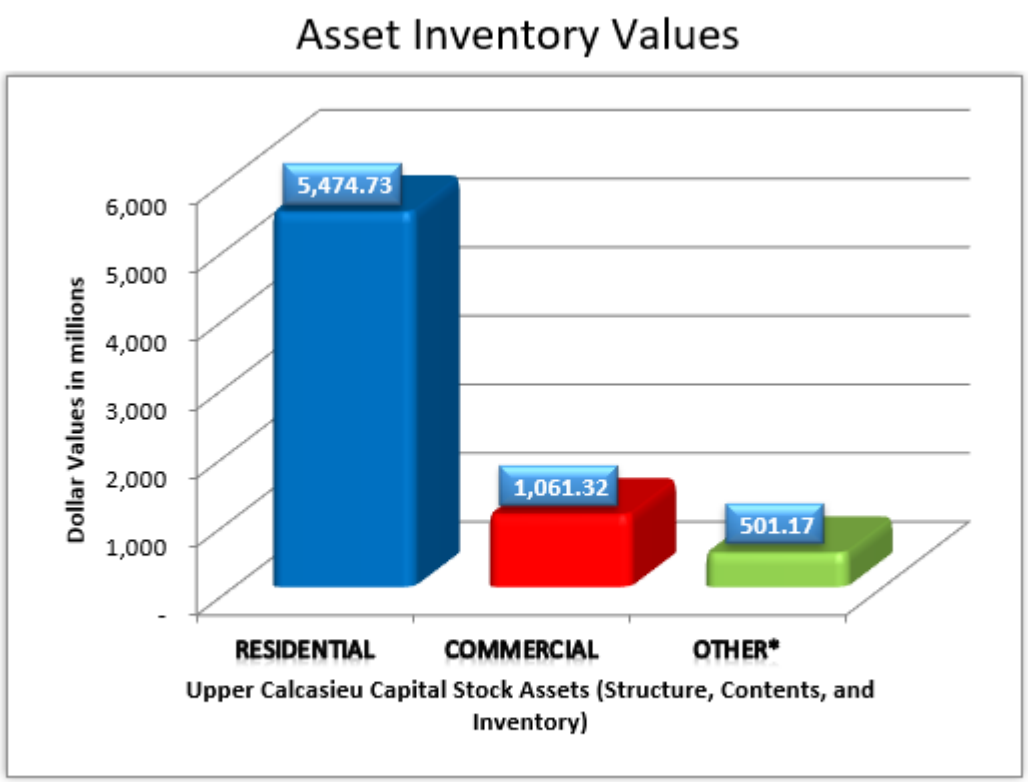
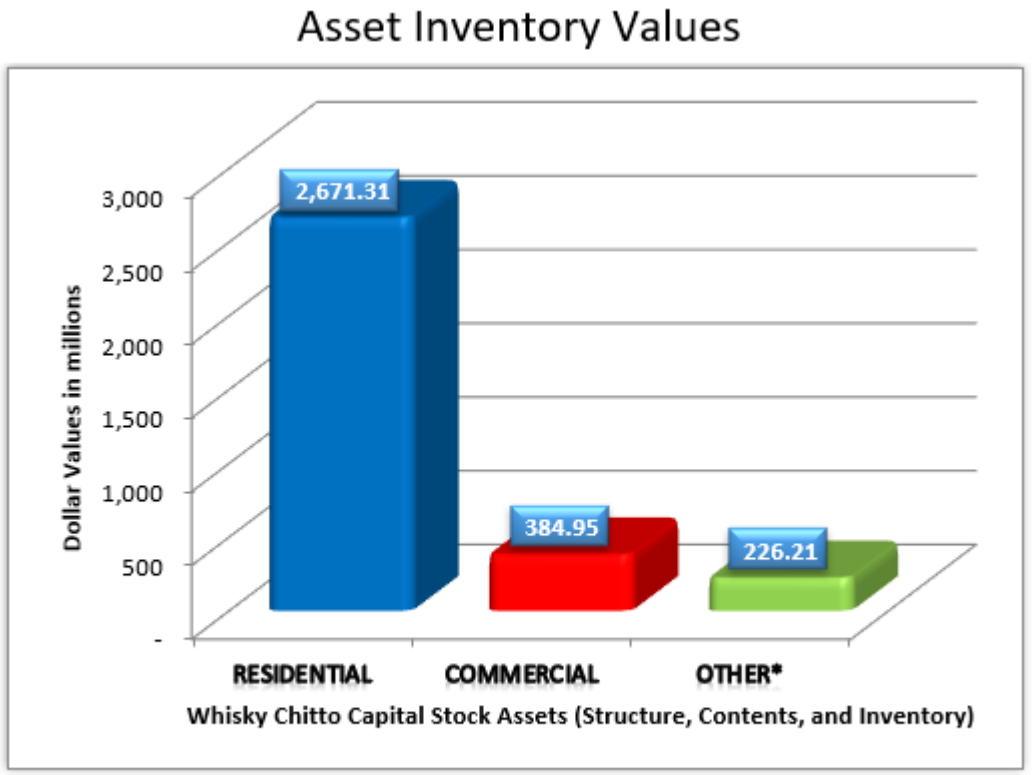
POST-DISCOVERY RESULTS

HAZUS-BASED ASSET INVENTORY VALUES



***Other** structure types include Industrial, Agricultural, Education, Religious and Government structures.



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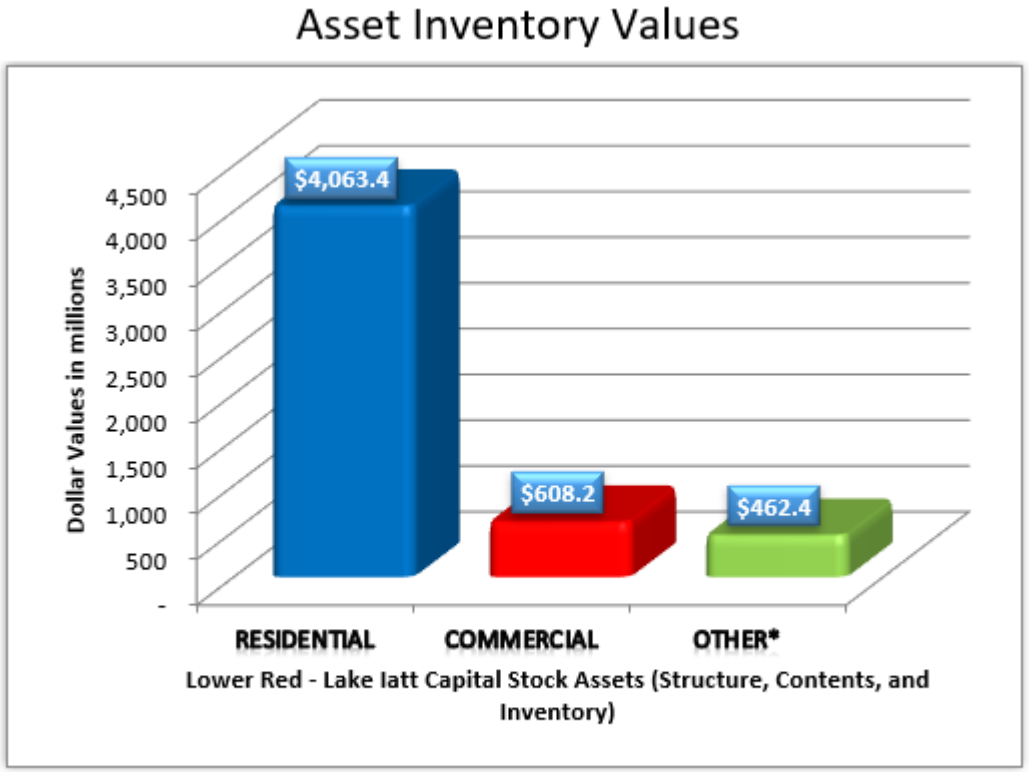
POST-DISCOVERY RESULTS

HAZUS-BASED ASSET INVENTORY VALUES



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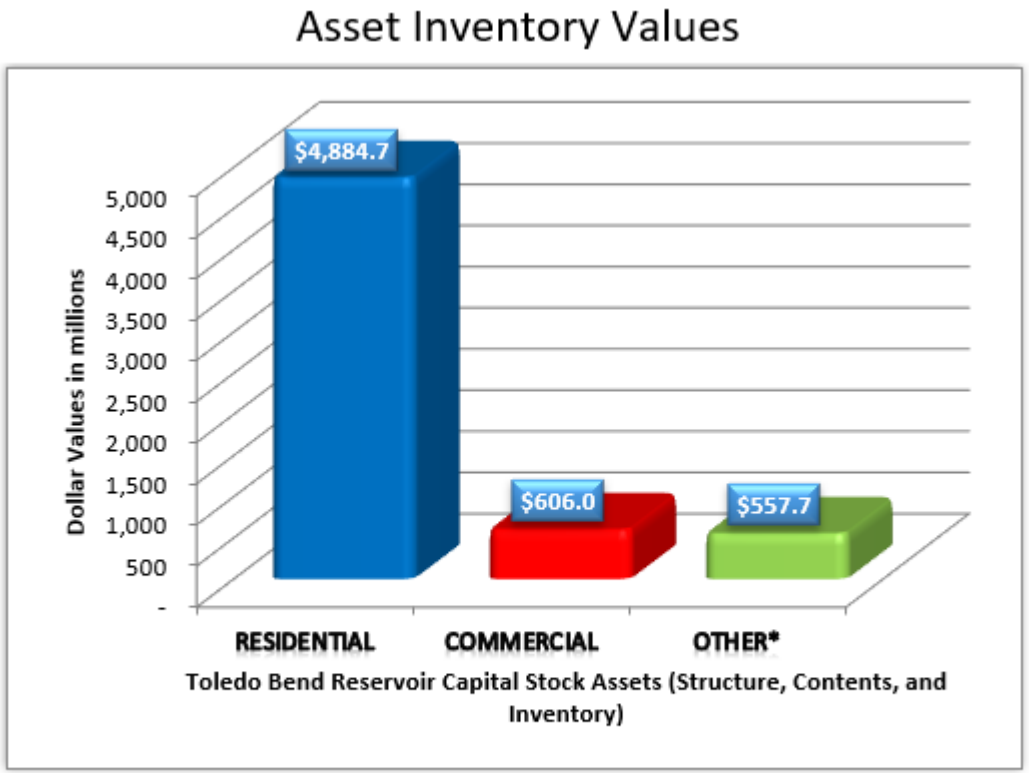

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POST-DISCOVERY RESULTS

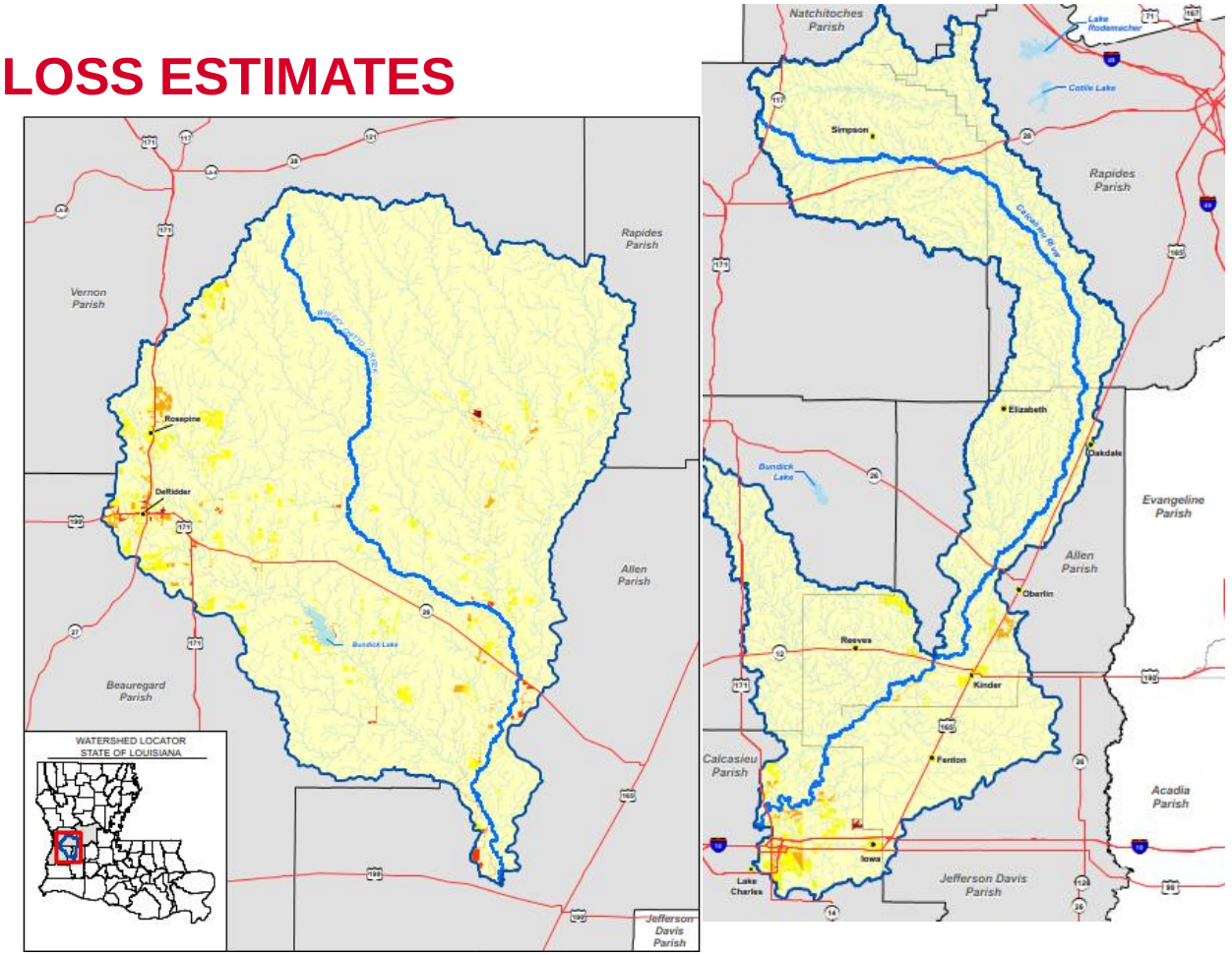
HAZUS-BASED 1% ANNUAL CHANCE LOSS ESTIMATES

Map Symbology

- Cities
- Tensas Bayou & Tensas River
- Other Streams
- Major Highways
- Watershed Boundary: HUC-8
- Lake
- States Boundary
- Discovery Parish Boundary
- Other Parish/County Boundary

Hazus 1%-Annual-Chance Loss Study*

- Very Low
- Low
- Medium
- High
- Very High



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POST-DISCOVERY RESULTS

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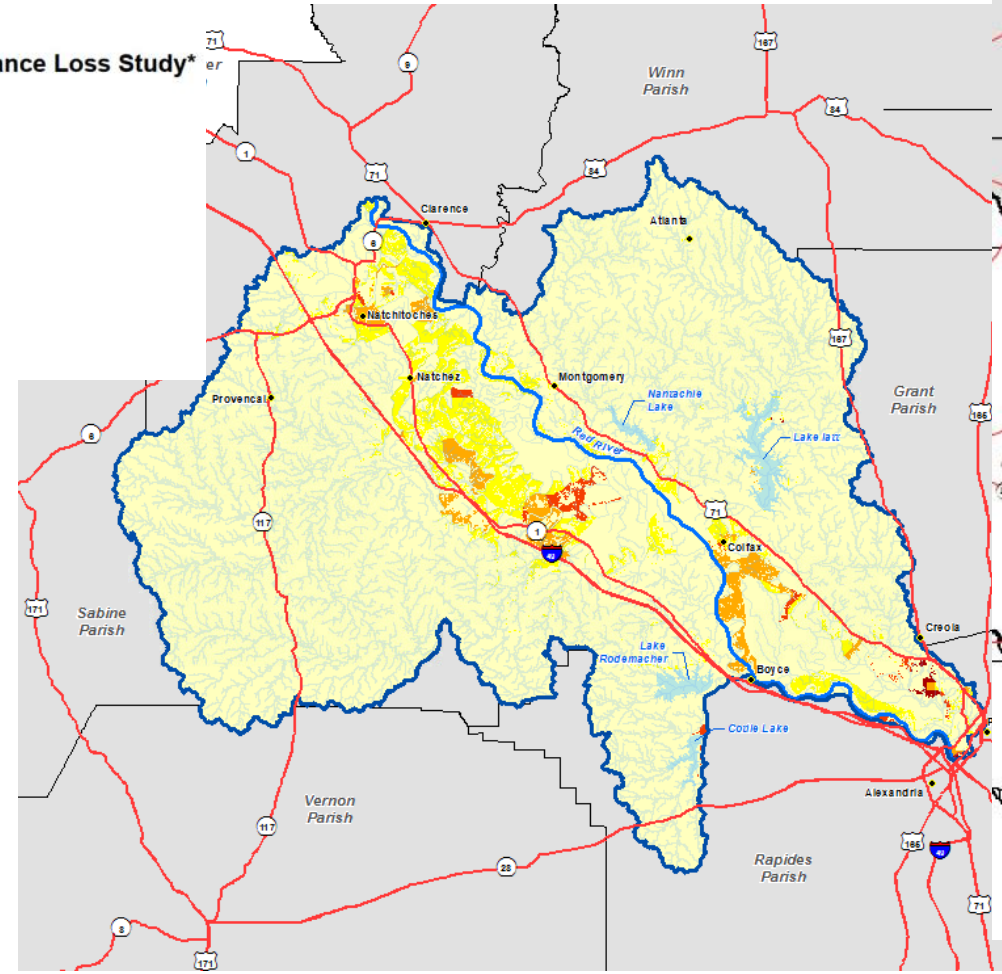

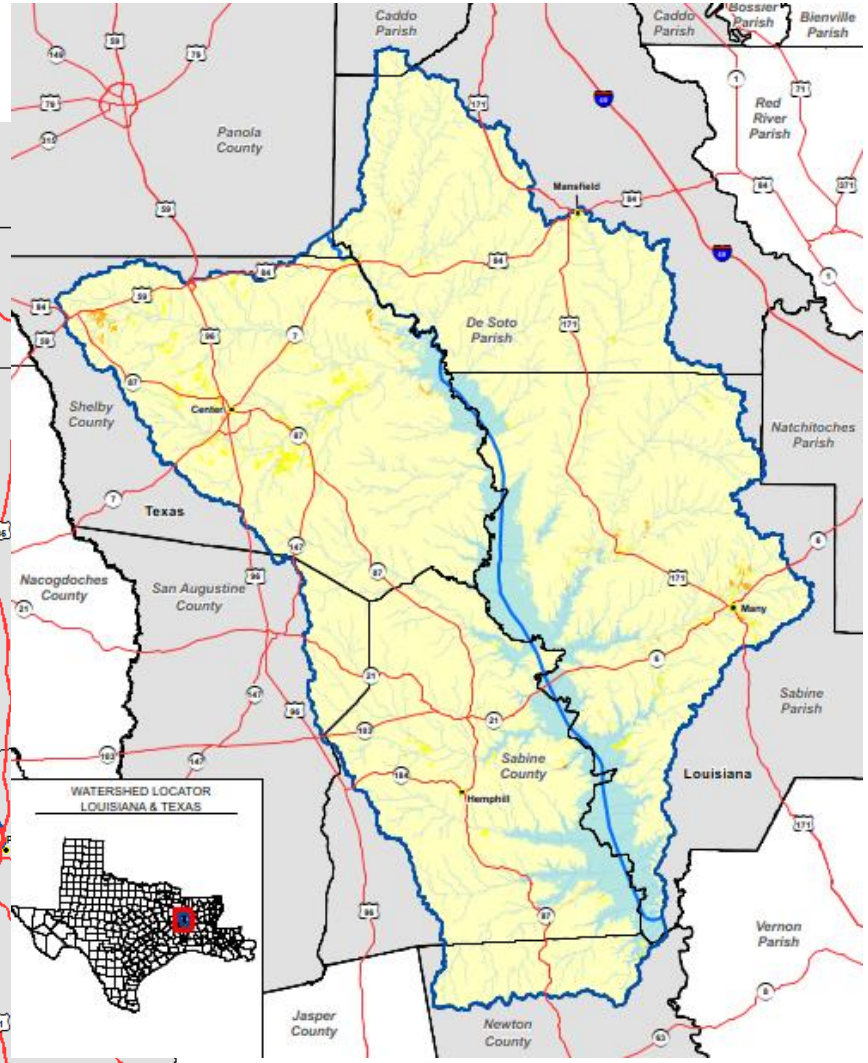

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BASE LEVEL ENGINEERING (BLE)

- BLE is developed at a larger scale (HUC8)
- LiDAR must be available
- Steps of Hydrology, Hydraulics & Terrain
- Model review and adjustments
- Gage review included in hydrology
- Used to assess flood risk



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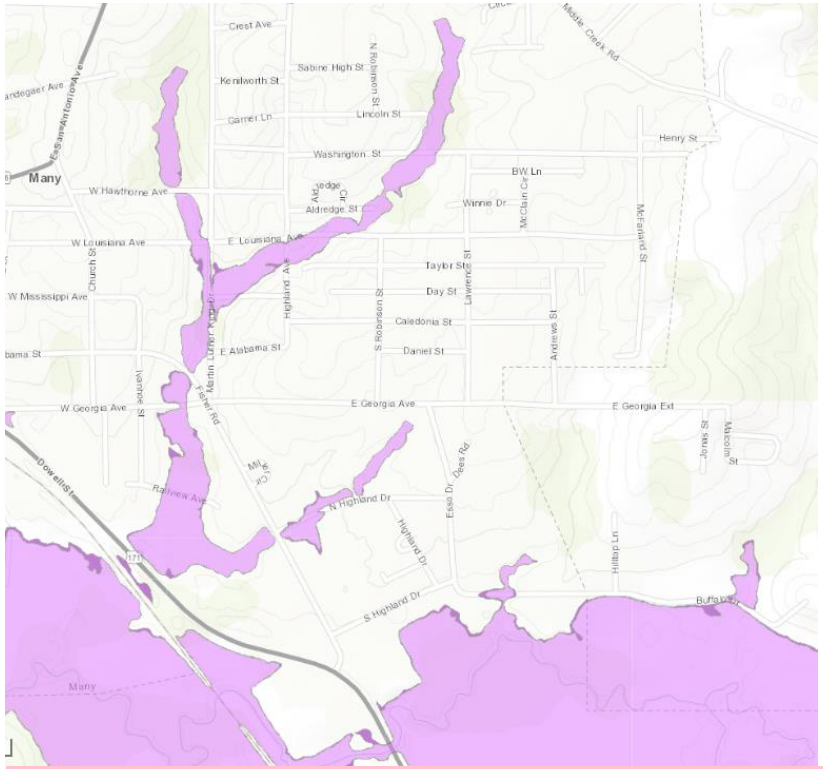
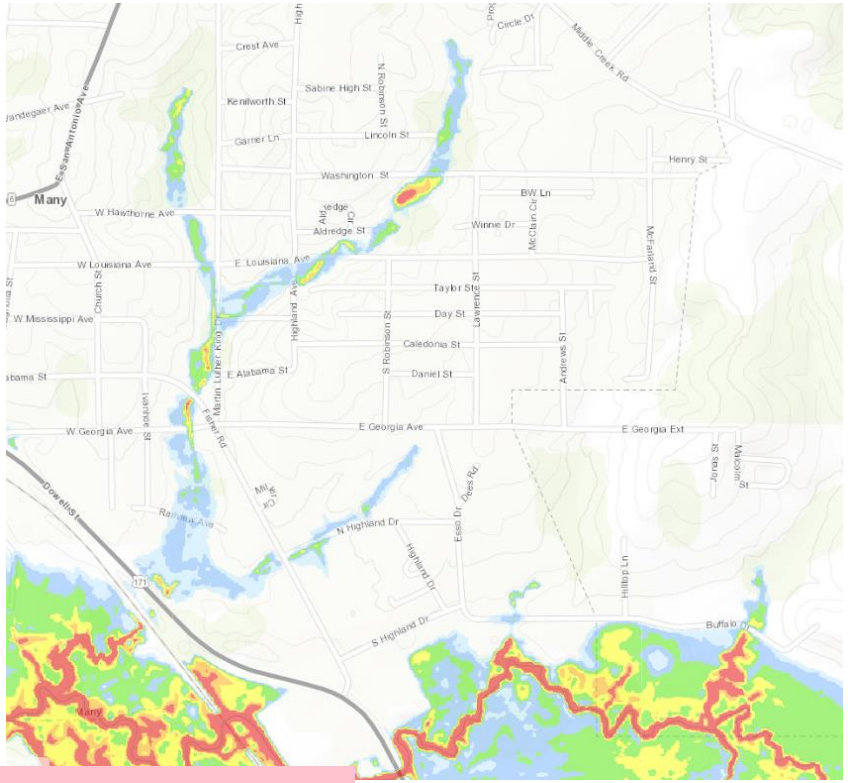
BASE LEVEL ENGINEERING (BLE)





- High risk (1% flood zone)
- Low to moderate risk (0.2% flood zone)

≤ 1 foot	> 3 to 4 feet
> 1 to 2 feet	> 4 to 5 feet
> 2 to 3 feet	> 5 feet

OUTPUTS

- Hydrology modeling (Regression) flows w/gage analysis
- Hydraulic modeling (HEC-RAS) for 10%, 4%, 2%, 1% and 0.2% storm events
- 10%, 1% and 0.2% floodplain boundaries

Non-Regulatory

- Areas of Expanded Flood Risk
- Depth and Analysis Grids
- Flood Risk Assessment

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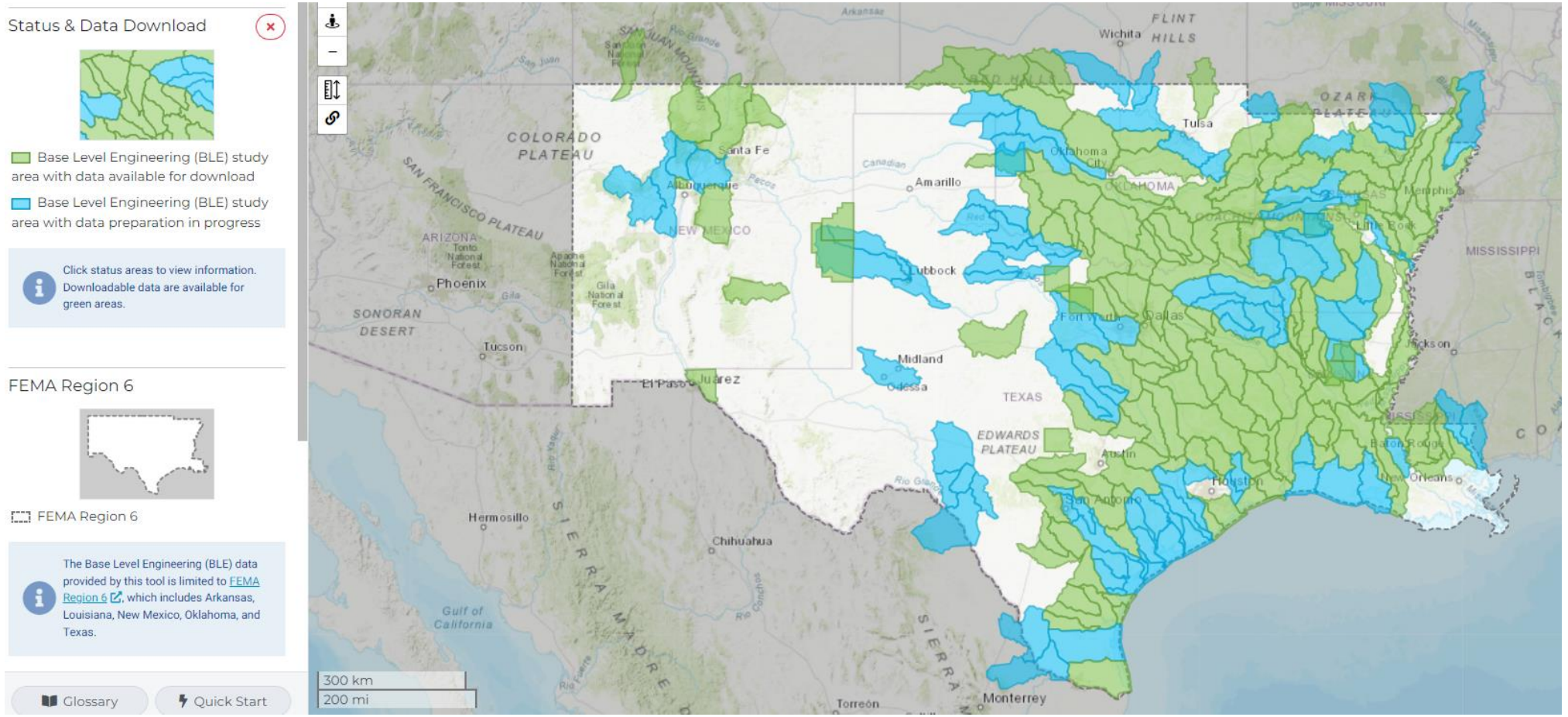
BASE LEVEL ENGINEERING (BLE)

- View and download completed BLE data
- Useful for determining BFEs for development

https://webapps.usgs.gov/infrm/estBFE/



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POST-DISCOVERY MEETING COORDINATION

FLOOD RISK REPORT

- Prioritization Results
- Summary of Discovery Activities
- Historical Flooding
- Figures and Maps
- Community Snapshots
- Stakeholder Comments

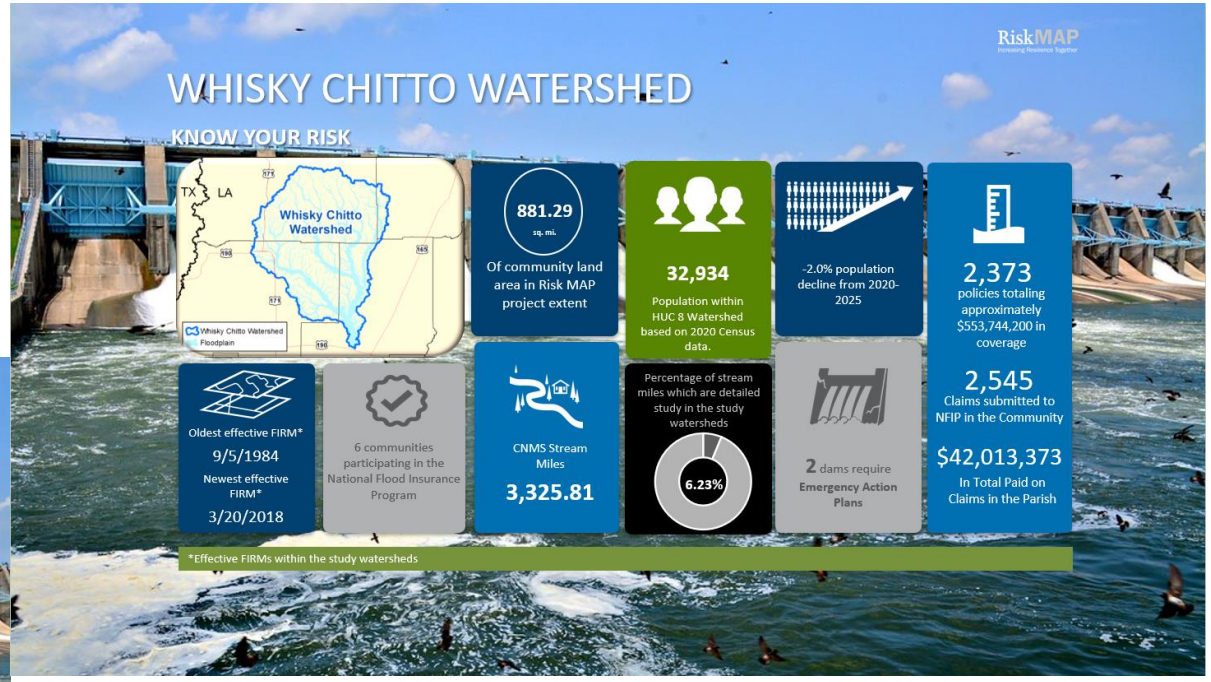


DISCOVERY | POST MEETING COORDINATION

FLOOD RISK REPORT

- Stakeholder Comments
- Community Snapshots
- BLE Report





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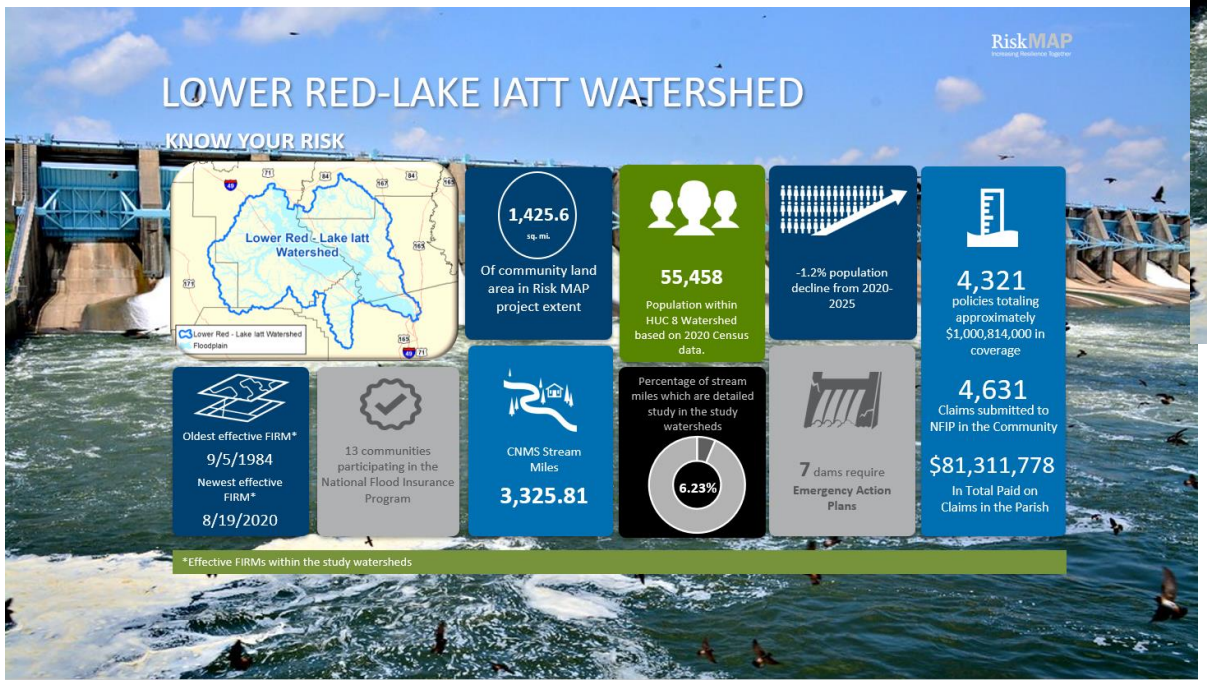
DISCOVERY | POST MEETING COORDINATION

FLOOD RISK REPORT

- Stakeholder Comments
- Community Snapshots
- BLE Report





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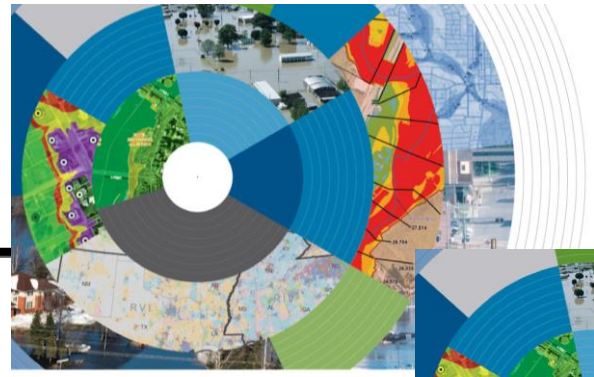
POST-DISCOVERY MEETING COORDINATION

BLE DATASET AND REVIEW



FLOOD RISK REPORT



Flood Risk Report

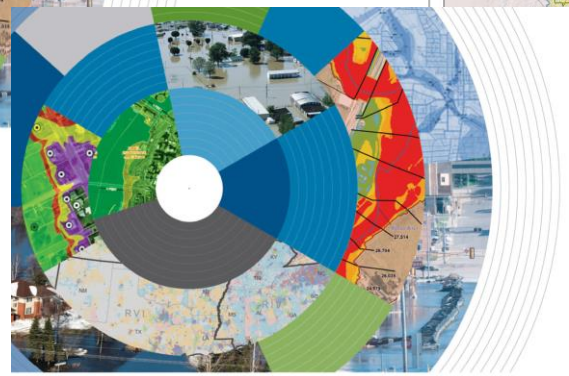
Whisky Chitto Watershed

HUC-8 08080204

FEMA CASE NUMBER: 22-06-0014S

March 2023

FEMA



Flood Risk Report

Upper Calcasieu Watershed

HUC-8 08080203

FEMA CASE NUMBER: 21-06-009S

March 2023

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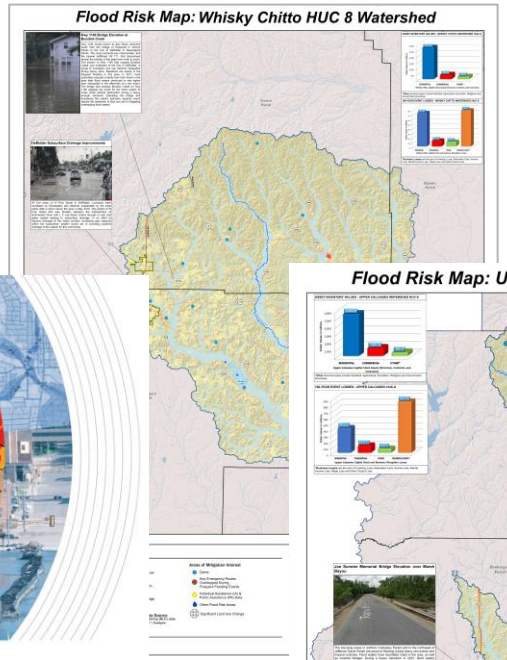
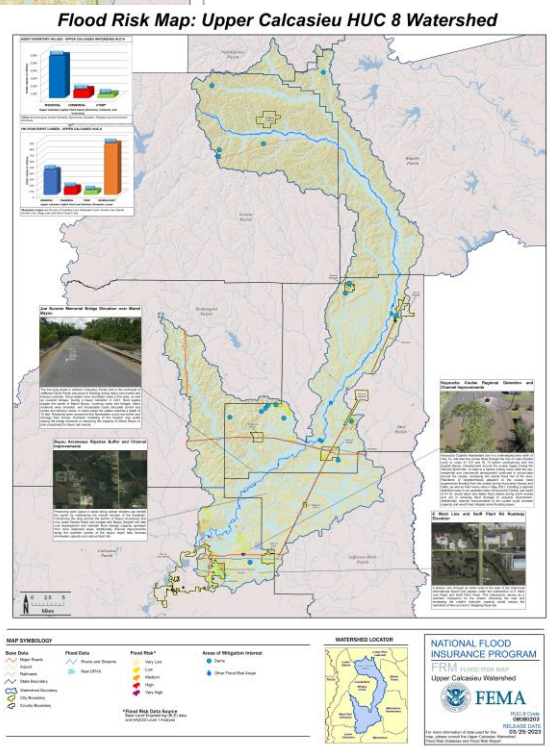
FLOOD RISK MAP





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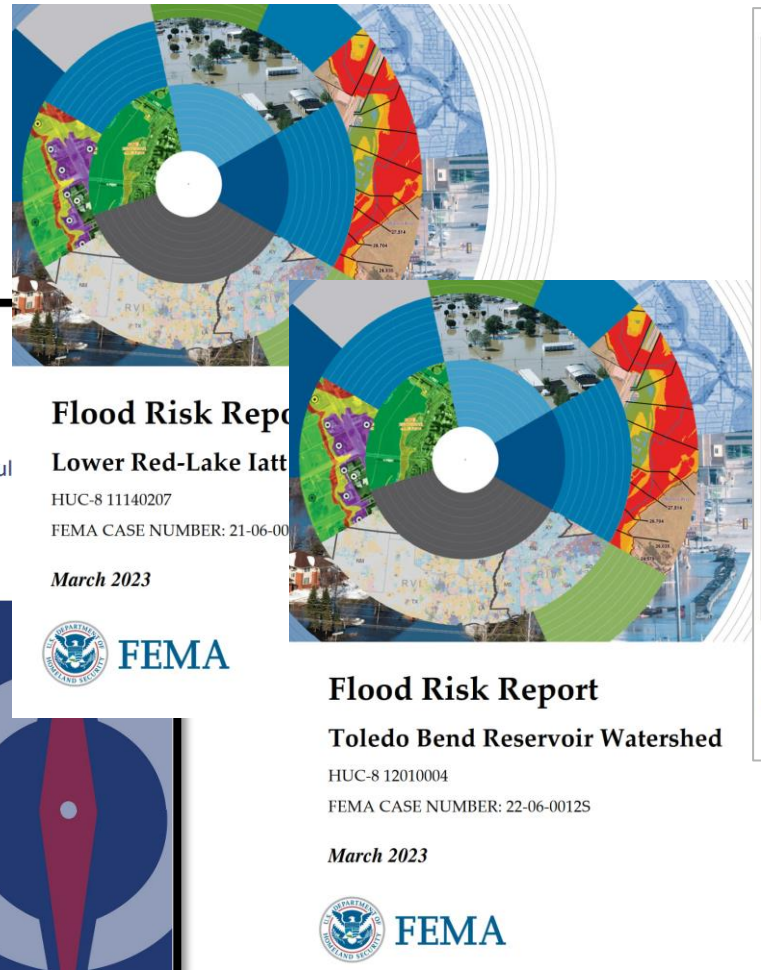
POST-DISCOVERY MEETING COORDINATION

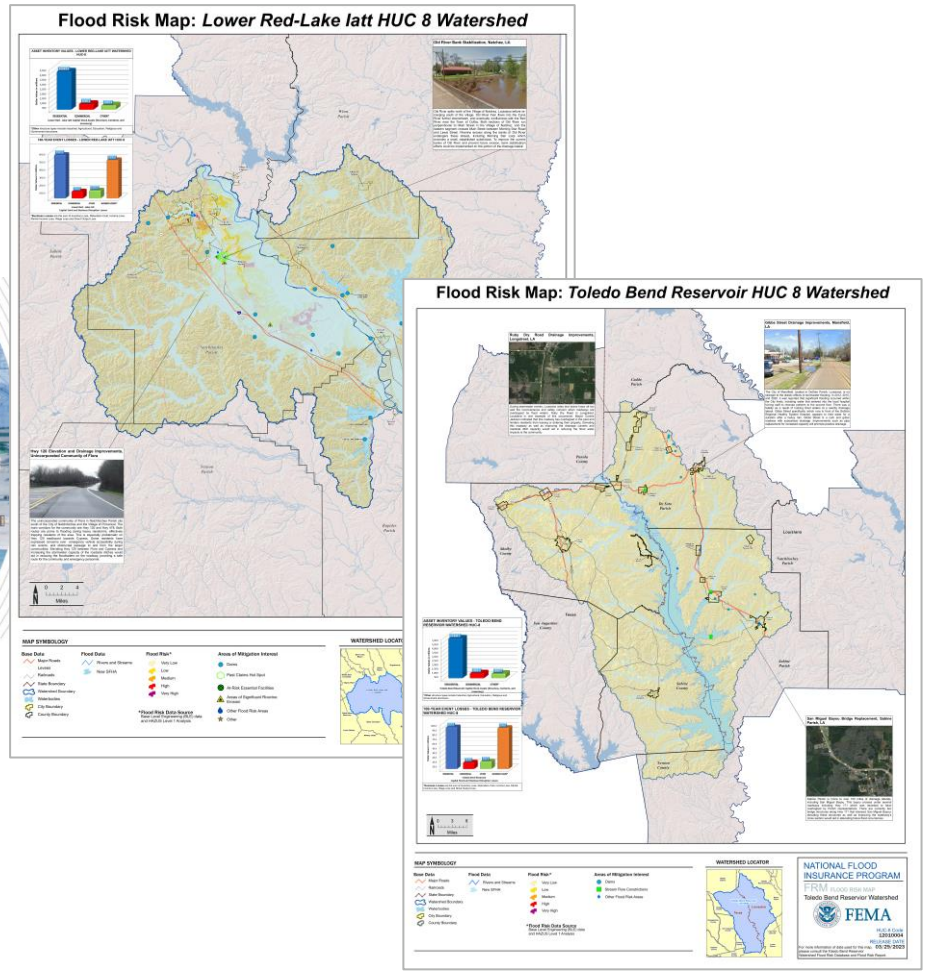
BLE DATASET AND REVIEW



FLOOD RISK REPORT



FLOOD RISK MAP



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POST-DISCOVERY RESULTS

MAPPING NEEDS PRIORITIZATION BY PARISH

Upper Calcasieu Watershed

Mapping Needs Prioritization by Parish		
Parish	**Priority**	**Reason**
Rapides	Highest	More than 20% of the stream miles are unverified, and the oldest effective date exceeds the last 35 years. No DFIRM.
Natchitoches	High	More than 40% of the stream miles are unverified, but the oldest effective date is within the last 10 years. DFIRM available.
Beauregard	Moderate	More than 40% of the stream miles are unverified, but the oldest effective date is within the last 15 years. DFIRM available.
Calcasieu	Moderate	More than 25% of the stream miles are unverified, but the oldest effective date is within the last 15 years. DFIRM available.
Allen	Low	Less than 15% of the stream miles are unverified, and the oldest effective date is within the last 15 years. DFIRM available.
Vernon	Low	Less than 20% of the stream miles are unverified, and the oldest effective date is within the last 15 years. DFIRM available.
Jefferson Davis	Low	Less than 5% of the stream miles are unverified, and the oldest effective date is within the last 5 years. DFIRM available.

Whisky Chitto Watershed

Mapping Needs Prioritization by Parish		
Parish	**Priority**	**Reason**
Rapides	Highest	More than 20% of the stream miles are unverified, and the oldest effective date exceeds the last 35 years. No DFIRM.
Beauregard	Moderate	More than 40% of the stream miles are unverified, but the oldest effective date is within the last 15 years. DFIRM available.
Allen	Low	Less than 15% of the stream miles are unverified, and the oldest effective date is within the last 15 years. DFIRM available.
Vernon	Low	Less than 20% of the stream miles are unverified, and the oldest effective date is within the last 15 years. DFIRM available.

POST-DISCOVERY RESULTS

MAPPING NEEDS PRIORITIZATION BY PARISH

Lower Red – Lake Iatt Watershed

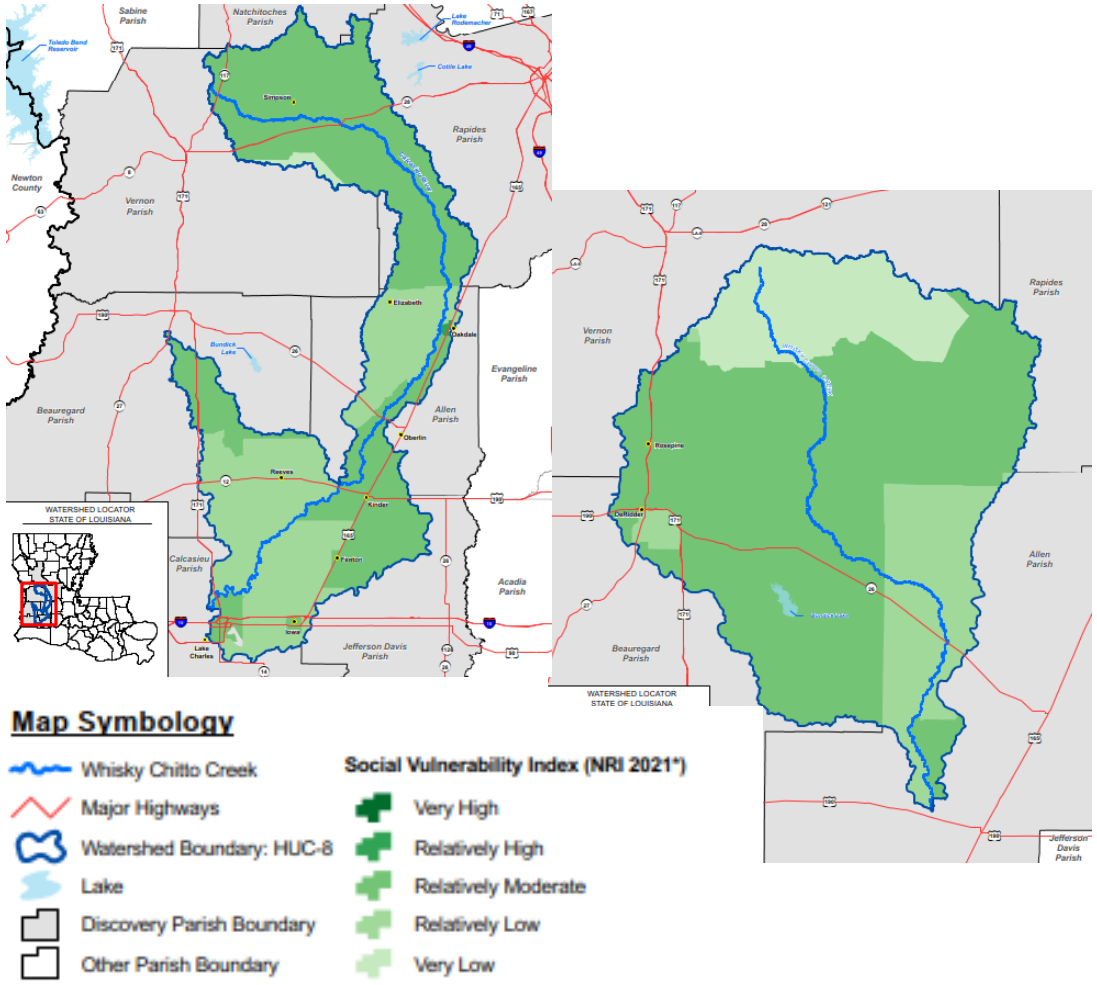
Mapping Needs Prioritization by Parish		
Parish	**Priority**	**Reason**
Rapides	Highest	More than 20% of the stream miles are unverified, and the oldest effective date exceeds the last 35 years. No DFIRM.
Sabine	High	More than 55% of the stream miles are unverified, and the oldest effective date exceeds the last 30 years. No DFIRM.
Natchitoches	High	More than 40% of the stream miles are unverified, but the oldest effective date is within the last 10 years. DFIRM available.
Grant	Moderate	More than 25% of the stream miles are unverified, but the oldest effective date is within the last 10 years. DFIRM available.
Vernon	Low	Less than 20% of the stream miles are unverified, and the oldest effective date is within the last 15 years. DFIRM available.
Winn	Low	Less than 5% of the stream miles are unverified, and the oldest effective date is within the last 5 years. DFIRM available.

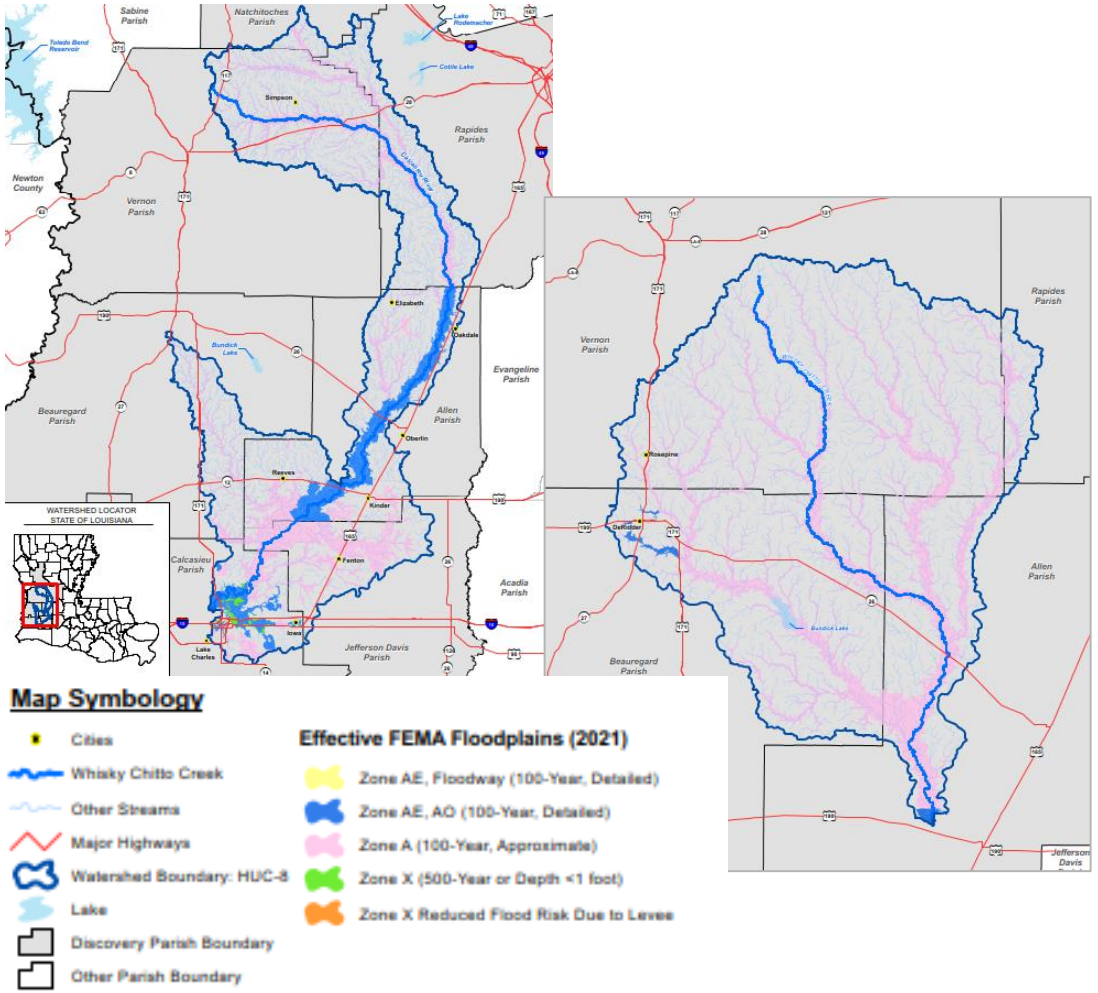
Toledo Bend Reservoir Watershed

Mapping Needs Prioritization by Parish		
Parish	**Priority**	**Reason**
Sabine	Highest	More than 55% of the stream miles are unverified, and the oldest effective date exceeds the last 30 years. No DFIRM.
Natchitoches	High	More than 40% of the stream miles are unverified, but the oldest effective date is within the last 10 years. DFIRM available.
De Soto	Moderate	More than 70% of the stream miles are unverified, but the oldest effective date is within the last 20 years. DFIRM available.
Caddo	Moderate	More than 30% of the stream miles are unverified, but the oldest effective date is within the last 10 years. DFIRM available.

RISK MAP PROJECT RECOMMENDATIONS TO FEMA

OTHER CONSIDERATIONS FOR MAPPING UPDATES





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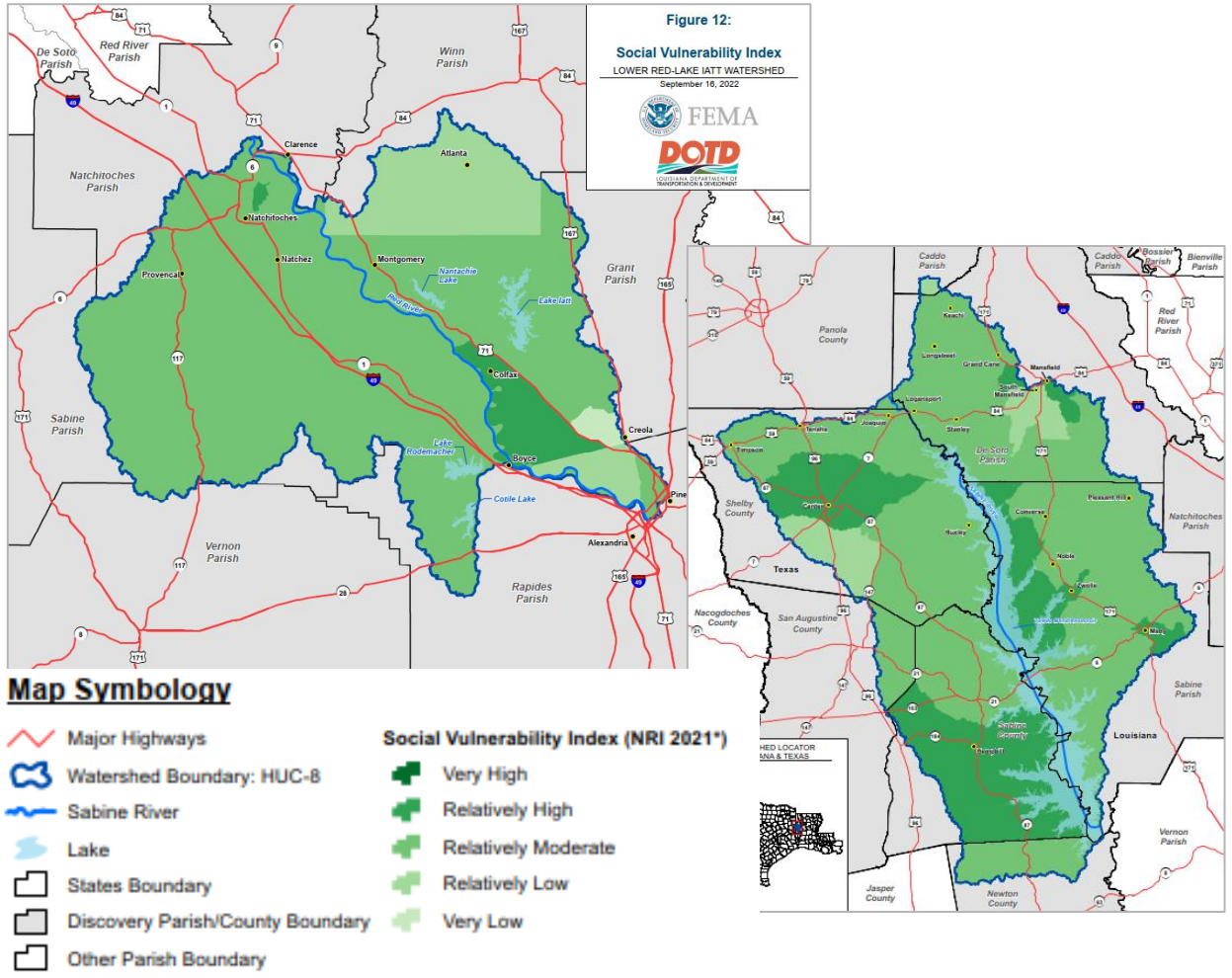
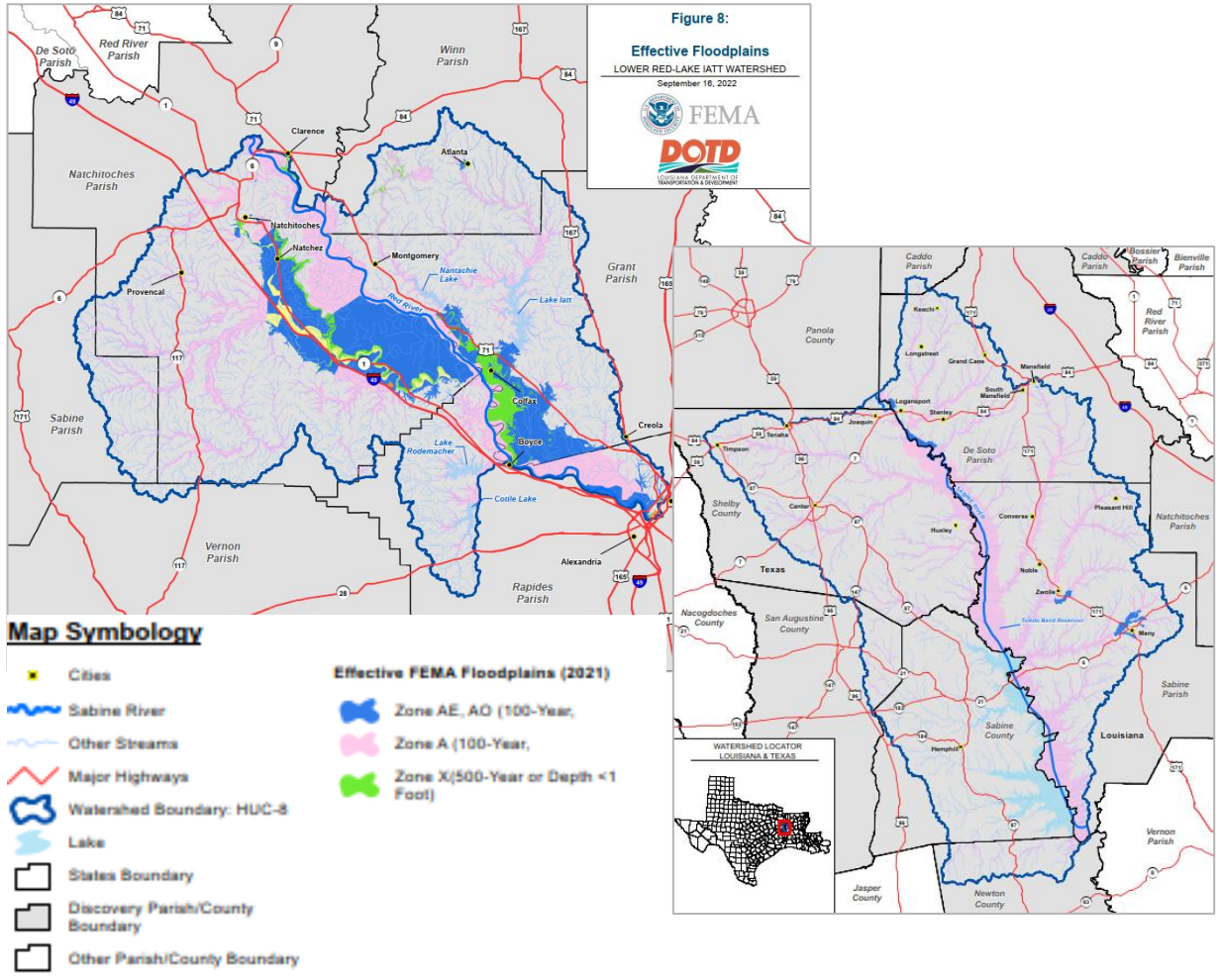
RISK MAP PROJECT RECOMMENDATIONS TO FEMA

OTHER CONSIDERATIONS FOR MAPPING UPDATES





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FEMA'S RISK MAPPING, ASSESSMENT, AND PLANNING (MAP) PROGRAM



QUESTIONS?



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THANK YOU!

Susan Veillon
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Discovery GIS Lead
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Appendix II: Community-Specific Reports

Snapshots

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TOLEDO BEND RESERVIOR WATERSHED

KNOW YOUR RISK



1,107.2 sq. mi.
Of community land area in Risk MAP project extent

33,069
Population within HUC 8 Watershed based on 2020 Census data.

-4.3% population decline from 2020-2025

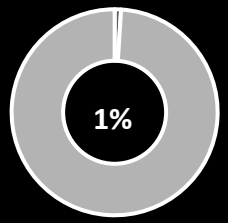
1,180
policies totaling approximately $23,241,330 in coverage

Oldest effective FIRM*
8/5/1991
Newest effective FIRM*
7/6/2015

8 communities participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed
2,740.67

Percentage of stream miles which are detailed study in the study watersheds



4 dams require **Emergency Action Plans**

920
Claims submitted to NFIP in the Community

$23,241,330
In Total Paid on Claims in the Parish

*Effective FIRMs within the study watersheds

RiskMAP
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CADDO PARISH

KNOW YOUR RISK



5.6 sq. mi.

of the community's land area is in the study watershed

217

Population based on 2020 Decennial Census in the study watershed

-5.9% expected population decline predicted from 2020-2025 in the community

628

policies totaling approximately $161,861,700 in coverage

433

Claims submitted to NFIP in the Community

$13,618,732

In Total Paid on Claims in the Community

0%

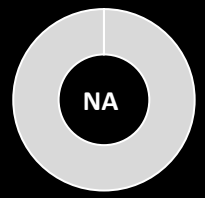
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

5.38

The are no detailed study stream miles in the study watershed



7

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

CADDO PARISH

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **November 2022.** An update to the plan began in October 2022.

The hazard mitigation goals identified projects for:

- Improve/enhance critical public facilities and equipment to ensure operability before, during, and after hazard events
- Enhance public safety and protect lives from dangers of natural hazards
- Facilitate sound development in the parish to reduce or eliminate the potential impact of hazards
- Enhance public awareness of natural hazards and understanding of disaster preparedness

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

The Louisiana Watershed Initiative (LWI) provides funding for local governments for flood risk reduction projects and project development capacity building through CDBG-Mitigation dollars. These funds are distributed through three rounds of competitive funding opportunities focused on projects that result in demonstrable flood mitigation[4].

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1. https://www.fema.gov/hazard-mitigation-assistance.
2. https://gohsep.la.gov/GRANTS/RECOVERY-GRANTS/Hazard-Mitigation-Assistance/Hazard-Mitigation-Overview
3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

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DESOTO PARISH

KNOW YOUR RISK



407.1 sq. mi.

of the community's land area is in the study watershed

12,468

Population based on 2020 Decennial Census in the study watershed

% expected population growth predicted from 2020-2025 in the community

61

policies totaling approximately $11,780,700 in coverage

26

Claims submitted to NFIP in the Community

$508,878

In Total Paid on Claims in the Community

41%

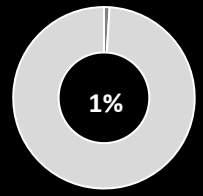
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

487.40

Percentage of stream miles which are detailed study in the study watersheds



3

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

DESOTO PARISH

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Reduce or prevent injury and loss of life
- Reduce or prevent damage to property and material assets
- Reduce or prevent damage to critical facilities essential for public safety including: fire, rescue, law enforcement communications, command and control
- Reduce or prevent damage to special facilities including: schools, nursing homes, hospitals and clinics, prisons, historical and cultural resources
- Reduce or prevent damage to infrastructure and loss of function
- Reduce or prevent damage to high-risk facilities

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2. https://gohsep.la.gov/GRANTS/RECOVERY-GRANTS/Hazard-Mitigation-Assistance/Hazard-Mitigation-Overview
3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

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VILLAGE OF GRAND CANE

KNOW YOUR RISK



1.2 sq. mi.

of the community's land area is in the study watershed

217

Population based on 2020 Decennial Census in the study watershed

-5.3% expected population decline predicted from 2020-2025 in the community

0

policies totaling approximately $0 in coverage

0

Claims submitted to NFIP in the Community

$0

In Total Paid on Claims in the Community

100%

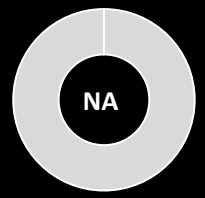
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

2.06

The are no detailed study stream miles in the study watershed



3

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

VILLAGE OF GRAND CANE

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Reduce or prevent injury and loss of life
- Reduce or prevent damage to property and material assets
- Reduce or prevent damage to critical facilities essential for public safety including: fire, rescue, law enforcement communications, command and control
- Reduce or prevent damage to special facilities including: schools, nursing homes, hospitals and clinics, prisons, historical and cultural resources
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3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
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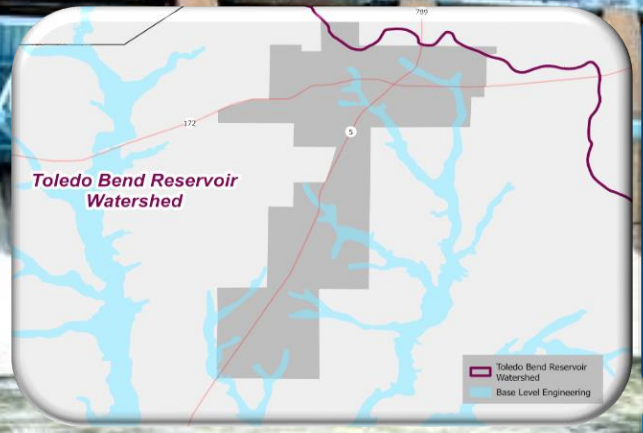
TOWN OF KEACHI

KNOW YOUR RISK



5.0 sq. mi.

of the community's land area is in the study watershed

238

Population based on 2020 Decennial Census in the study watershed

-9.3% expected population decline predicted from 2020-2025 in the community

0

policies totaling approximately N/A in coverage

0

Claims submitted to NFIP in the Community

$0

In Total Paid on Claims in the Community

100%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

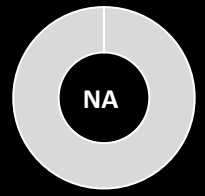
X

Does not participate in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

7.21

The are no detailed study stream miles in the study watershed



3

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

TOWN OF KEACHI

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Reduce or prevent injury and loss of life
- Reduce or prevent damage to property and material assets
- Reduce or prevent damage to critical facilities essential for public safety including: fire, rescue, law enforcement communications, command and control
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TOWN OF LOGANSPORT

KNOW YOUR RISK



1.60 sq. mi.

of the community's land area is in the study watershed

625

Population based on 2020 Decennial Census in the study watershed

-7.2% expected population decline predicted from 2020-2025 in the community

0

policies totaling approximately $0 in coverage

1

Claims submitted to NFIP in the Community

$938

documented severe repetitive loss properties in the study watershed

100%

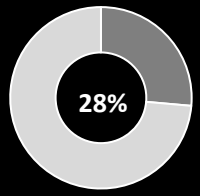
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

5.52

Percentage of stream miles which are detailed study in the study watersheds



3

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

TOWN OF LOGANSPORT

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Reduce or prevent injury and loss of life
- Reduce or prevent damage to property and material assets
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3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

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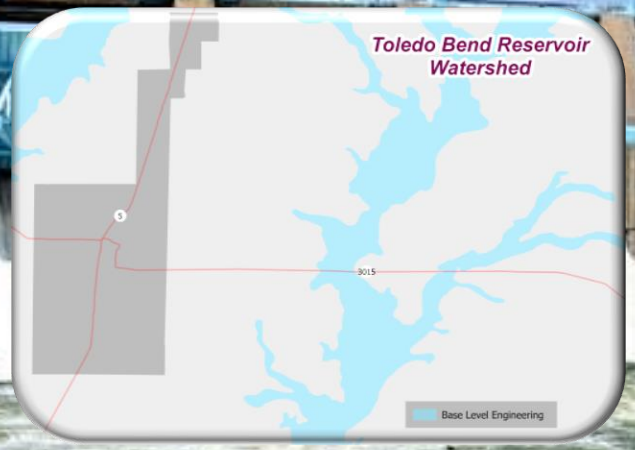
VILLAGE OF LONGSTREET

KNOW YOUR RISK



2.10 sq. mi.

of the community's land area is in the study watershed

157

Population based on 2020 Decennial Census in the study watershed

-14.4% expected population decline predicted from 2020-2025 in the community

0

policies totaling approximately $0 in coverage

0

Claims submitted to NFIP in the Community

$0

In Total Paid on Claims in the Community

0.0%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

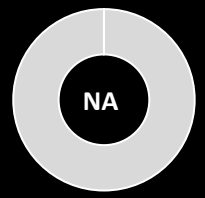
X

Does not participate in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

0.0

The are no detailed study stream miles in the study watershed



3

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

VILLAGE OF LONGSTREET

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Reduce or prevent injury and loss of life
- Reduce or prevent damage to property and material assets
- Reduce or prevent damage to critical facilities essential for public safety including: fire, rescue, law enforcement communications, command and control
- Reduce or prevent damage to special facilities including: schools, nursing homes, hospitals and clinics, prisons, historical and cultural resources
- Reduce or prevent damage to infrastructure and loss of function
- Reduce or prevent damage to high-risk facilities

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The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1. https://www.fema.gov/hazard-mitigation-assistance.
2. https://gohsep.la.gov/GRANTS/RECOVERY-GRANTS/Hazard-Mitigation-Assistance/Hazard-Mitigation-Overview
3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

RiskMAP
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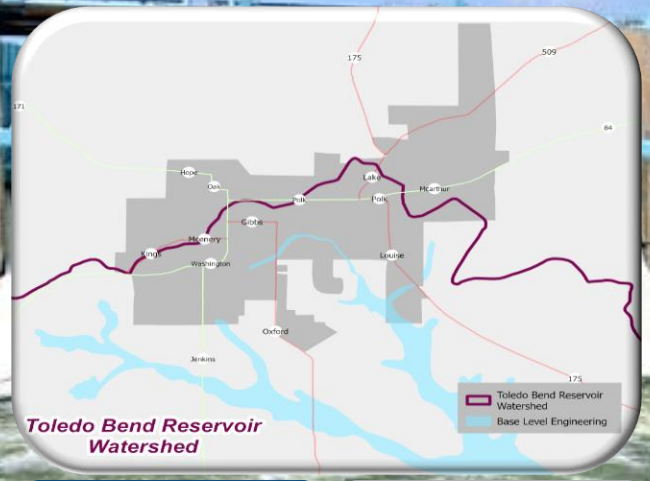
CITY OF MANSFIELD

KNOW YOUR RISK



1.00 sq. mi.

of the community's land area is in the study watershed

2,573

Population based on 2020 Decennial Census in the study watershed

-2.9% expected population decline predicted from 2020-2025 in the community

12

policies totaling approximately $2,657,600 in coverage

10

Claims submitted to NFIP in the Community

$227,426

In Total Paid on Claims in the Community

30%

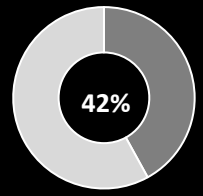
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

1.83

Percentage of stream miles which are detailed study in the study watersheds



3

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

CITY OF MANSFIELD

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

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- Reduce or prevent injury and loss of life
- Reduce or prevent damage to property and material assets
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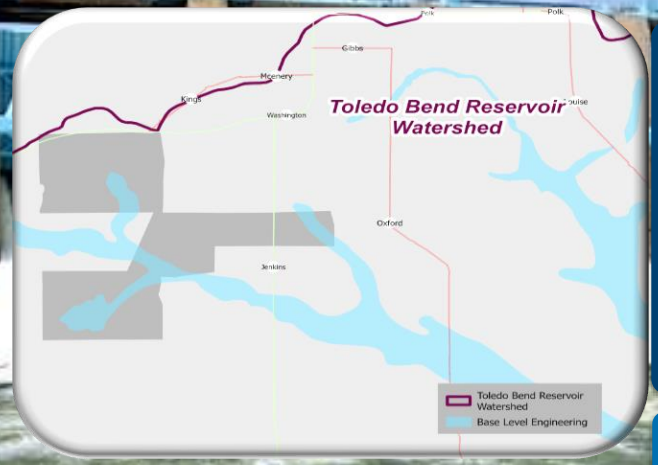
Increasing Resilience Together

VILLAGE OF SOUTH MANSFIELD

KNOW YOUR RISK



0.7 sq. mi.

of the community's land area is in the study watershed

357

Population based on 2020 Decennial Census in the study watershed

1.6% expected population growth predicted from 2020-2025 in the community

0

policies totaling approximately $0 in coverage

0

Claims submitted to NFIP in the Community

$0

In Total Paid on Claims in the Community

100%

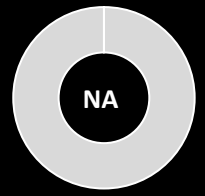
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in Toledo Bend Reservoir Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

1.68

The are no detailed study stream miles in the study watershed



3

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

VILLAGE OF SOUTH MANSFIELD

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Reduce or prevent injury and loss of life
- Reduce or prevent damage to property and material assets
- Reduce or prevent damage to critical facilities essential for public safety including: fire, rescue, law enforcement communications, command and control
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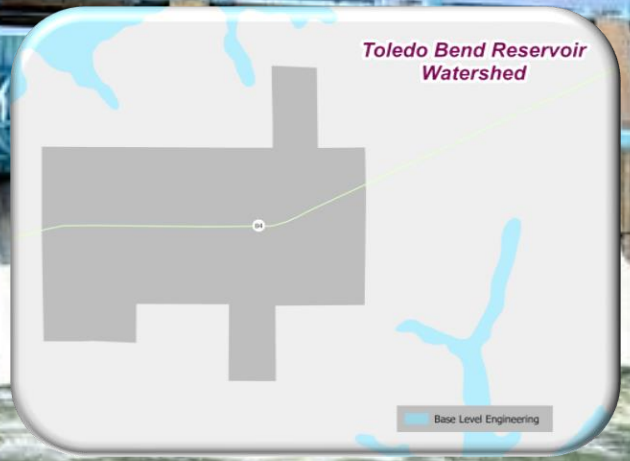
VILLAGE OF STANLEY

KNOW YOUR RISK



2.20 sq. mi.

of the community's land area is in the study watershed

132

Population based on 2020 Decennial Census in the study watershed

11.1% expected population growth predicted from 2020-2025 in the community

0

policies totaling approximately $0 in coverage

0

Claims submitted to NFIP in the Community

$0

In Total Paid on Claims in the Community

0.0%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

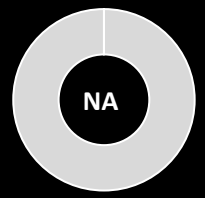
X

Does not participate in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

0.0

The are no detailed study stream miles in the study watershed



3

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

VILLAGE OF STANLEY

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Reduce or prevent injury and loss of life
- Reduce or prevent damage to property and material assets
- Reduce or prevent damage to critical facilities essential for public safety including: fire, rescue, law enforcement communications, command and control
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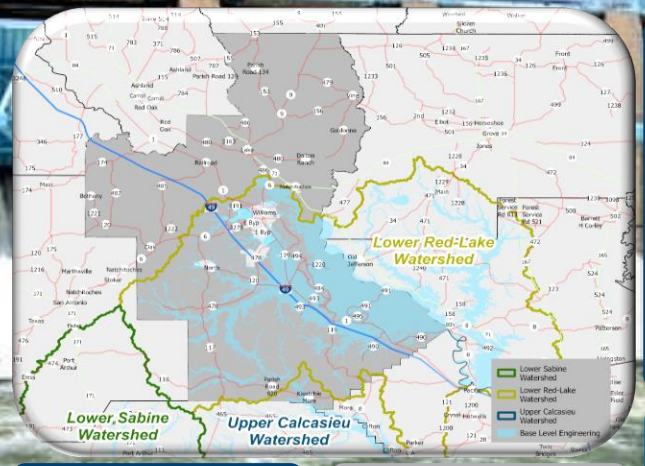
NATCHITOCHES PARISH

KNOW YOUR RISK



0.0* sq. mi.

of the community's land area is in the study watershed

0

Population based on 2020 Decennial Census in the study watershed

0% expected population growth predicted from 2020-2025 in the community

381

policies totaling approximately $82,470,700 in coverage

429

Claims submitted to NFIP in the Community

$8,342,885

In Total Paid on Claims in the Community

0%

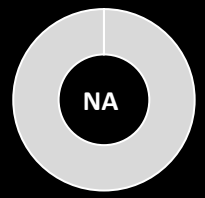
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

0.0

The are no detailed study stream miles in the study watershed



7

Flood-related presidential disaster declarations in your Discovery study parish

* Less than 1% of Natchitoches Parish is located within the Toledo Bend Reservoir watershed.
**National Flood Hazard Layer (NFHL)

NATCHITOCHES PARISH

TAKE ACTION: Potential Next Step



Your Hazard Mitigation Plan expiration date is **February 22, 2021.**

The hazard mitigation goals identified projects for:

- Limit development in flood plain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

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SABINE PARISH

KNOW YOUR RISK



667.4 sq. mi.

of the community's land area is in the study watershed

10,722

Population based on 2020 Decennial Census in the study watershed

-3.9% expected population decline predicted from 2020-2025 in the community

74

policies totaling approximately $16,943,800 in coverage

16

Claims submitted to NFIP in the Community

82%

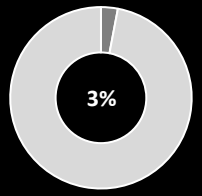
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

836.46

Percentage of stream miles which are detailed study in the study watersheds



2

Flood-related presidential disaster declarations in your Discovery study parish

$405,023

In Total Paid on Claims in the Community

*National Flood Hazard Layer (NFHL)

SABINE PARISH

TAKE ACTION: Potential Next Step



Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness
- Reduce repetitive flood losses in the parish and municipalities
- Facilitate sound development in the parish and municipalities so as to reduce or eliminate the potential impact of hazards

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

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VILLAGE OF CONVERSE

KNOW YOUR RISK



2.20 sq. mi.

of the community's land area is in the study watershed

379

Population based on 2020 Decennial Census in the study watershed

-7.2% expected population decline predicted from 2020-2025 in the community

0

policies totaling approximately $0 in coverage

0

Claims submitted to NFIP in the Community

$0

In Total Paid on Claims in the Community

100%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

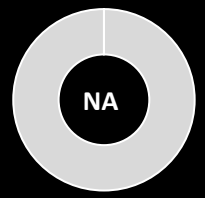
X

Does not participate in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

1.84

The are no detailed study stream miles in the study watershed



2

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

VILLAGE OF CONVERSE

TAKE ACTION: Potential Next Step



Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness
- Reduce repetitive flood losses in the parish and municipalities
- Facilitate sound development in the parish and municipalities so as to reduce or eliminate the potential impact of hazards

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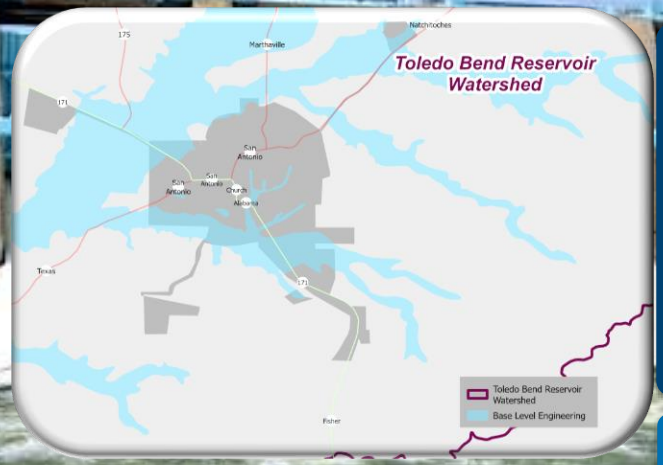
Increasing Resilience Together

TOWN OF MANY

KNOW YOUR RISK



3.50 sq. mi.

of the community's land area is in the study watershed

2,571

Population based on 2020 Decennial Census in the study watershed

-5.1% expected population decline predicted from 2020-2025 in the community

23

policies totaling approximately $1,954,800 in coverage

5

Claims submitted to NFIP in the Community

$65,448

In Total Paid on Claims in the Community

100%

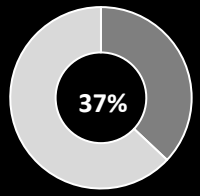
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

6.62

Percentage of stream miles which are detailed study in the study watersheds



2

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

TOWN OF MANY

TAKE ACTION: Potential Next Step



Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness
- Reduce repetitive flood losses in the parish and municipalities
- Facilitate sound development in the parish and municipalities so as to reduce or eliminate the potential impact of hazards

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4. https://watershed.la.gov/local-regional-projects-programs

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VILLAGE OF NOBLE

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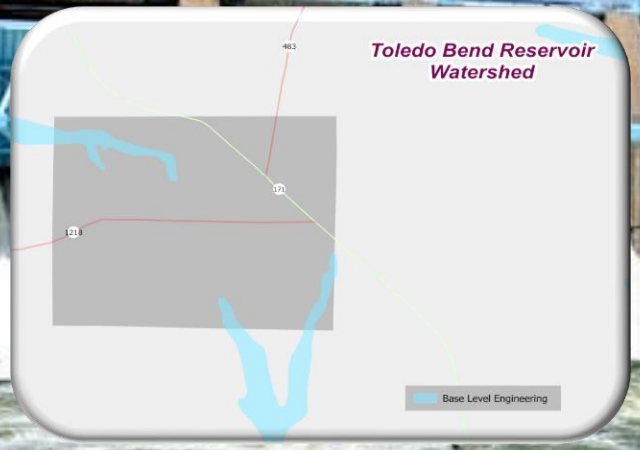


1.0 sq. mi.

of the community's land area is in the study watershed

200

Population based on 2020 Decennial Census in the study watershed

-10.9% expected population decline predicted from 2020-2025 in the community

0

policies totaling approximately $0 in coverage

0

Claims submitted to NFIP in the Community

$0

In Total Paid on Claims in the Community

100%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

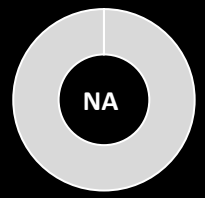
X

Does not participate in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

1.10

The are no detailed study stream miles in the study watershed



2

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

VILLAGE OF NOBLE

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
- Enhance public awareness and understanding of disaster preparedness
- Reduce repetitive flood losses in the parish and municipalities
- Facilitate sound development in the parish and municipalities so as to reduce or eliminate the potential impact of hazards

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

The Louisiana Watershed Initiative (LWI) provides funding for local governments for flood risk reduction projects and project development capacity building through CDBG-Mitigation dollars. These funds are distributed through three rounds of competitive funding opportunities focused on projects that result in demonstrable flood mitigation[4].

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1. https://www.fema.gov/hazard-mitigation-assistance.
2. https://gohsep.la.gov/GRANTS/RECOVERY-GRANTS/Hazard-Mitigation-Assistance/Hazard-Mitigation-Overview
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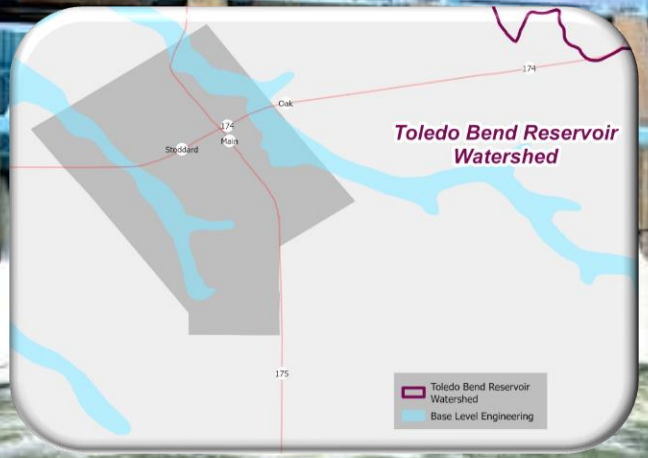


1.60 sq. mi.

of the community's land area is in the study watershed

617

Population based on 2020 Decennial Census in the study watershed

-7.6% expected population decline predicted from 2020-2025 in the community

0

policies totaling approximately $0 in coverage

0

Claims submitted to NFIP in the Community

$0

In Total Paid on Claims in the Community

100%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

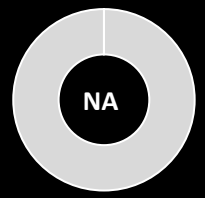
X

Does not participate in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

3.28

The are no detailed study stream miles in the study watershed



2

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

VILLAGE OF PLEASANT HILL

TAKE ACTION: Potential Next Step



Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
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3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

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TOWN OF ZWOLLE

KNOW YOUR RISK



5.0 sq. mi.

of the community's land area is in the study watershed

1,638

Population based on 2020 Decennial Census in the study watershed

-3.5% expected population decline predicted from 2020-2025 in the community

1

policies totaling approximately $45,000 in coverage

0

Claims submitted to NFIP in the Community

$0

In Total Paid on Claims in the Community

100%

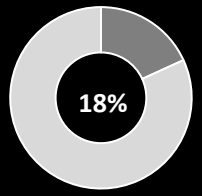
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the Toledo Bend Reservoir Watershed

Participating in the National Flood Insurance Program

CNMS Stream Miles in the study watershed

9.16

Percentage of stream miles which are detailed study in the study watersheds



2

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

TOWN OF ZWOLLE

TAKE ACTION: Potential Next Step



Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Identify and pursue preventative measures that will reduce future damages from hazards
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3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

Table 10: Toledo Bend Reservoir Watershed Community Overview

CID	Community	*Total Community Population*[1]	Percent of Population in Study Watershed	Total Community Land Area (sq. mi)	Percent of Land Area in Study Watershed	NFIP Participant
220361	**Caddo Parish**	*37,805*	0.6%	939.9	0.6%	Y
220363	**DeSoto Parish**	*26,812*	46.5%	875.4	46.5%	Y
220291	**Village of Grand Cane**	*217*	100.0%	1.2	100.0%	Y
220297	**Town of Keachi**	*243*	97.9%	5.1	98.0%	N
220336	**Town of Logansport**	*1,340*	46.7%	3.5	45.7%	Y
	Village of Longstreet	*115*	100.0%	2.1	100.0%	Y
220337	**City of Mansfield**	*4,714*	54.6%	3.7	54.1%	Y
220313	**Village of South Mansfield**	*357*	100.0%	0.7	100.0%	Y
	Village of Stanley	*132*	100.0%	2.2	100.0%	Y
220129	**Natchitoches Parish**	*16,406*	0.0%	1,268.80	0.0%	Y
220368	**Sabine Parish**	*16,000*	67.0%	996.1	67.0%	Y
220268	**Village of Converse**	*379*	100.0%	2.2	100.0%	Y
220158	**Town of Many**	*2,571*	100.0%	3.5	100.0%	Y
220301	**Village of Noble**	*200*	100.0%	1	100.0%	N
220344	**Village of Pleasant Hill**	*617*	100.0%	1.6	100.0%	Y
220353	**Town of Zwolle**	*1,638*	100.0%	5	100.0%	Y

[1]*2020 United States Census Bureau Population Estimate*

Appendix III: Base Level Engineering Report

Toledo Bend Watershed, LA/TX
Base Level Engineering (BLE) Results

Contract #HSFE60-15-D-0003, Task Order #70FA6019F00000035
November 2020

Prepared for:

DHS/FEMA (Federal Emergency Management Agency)
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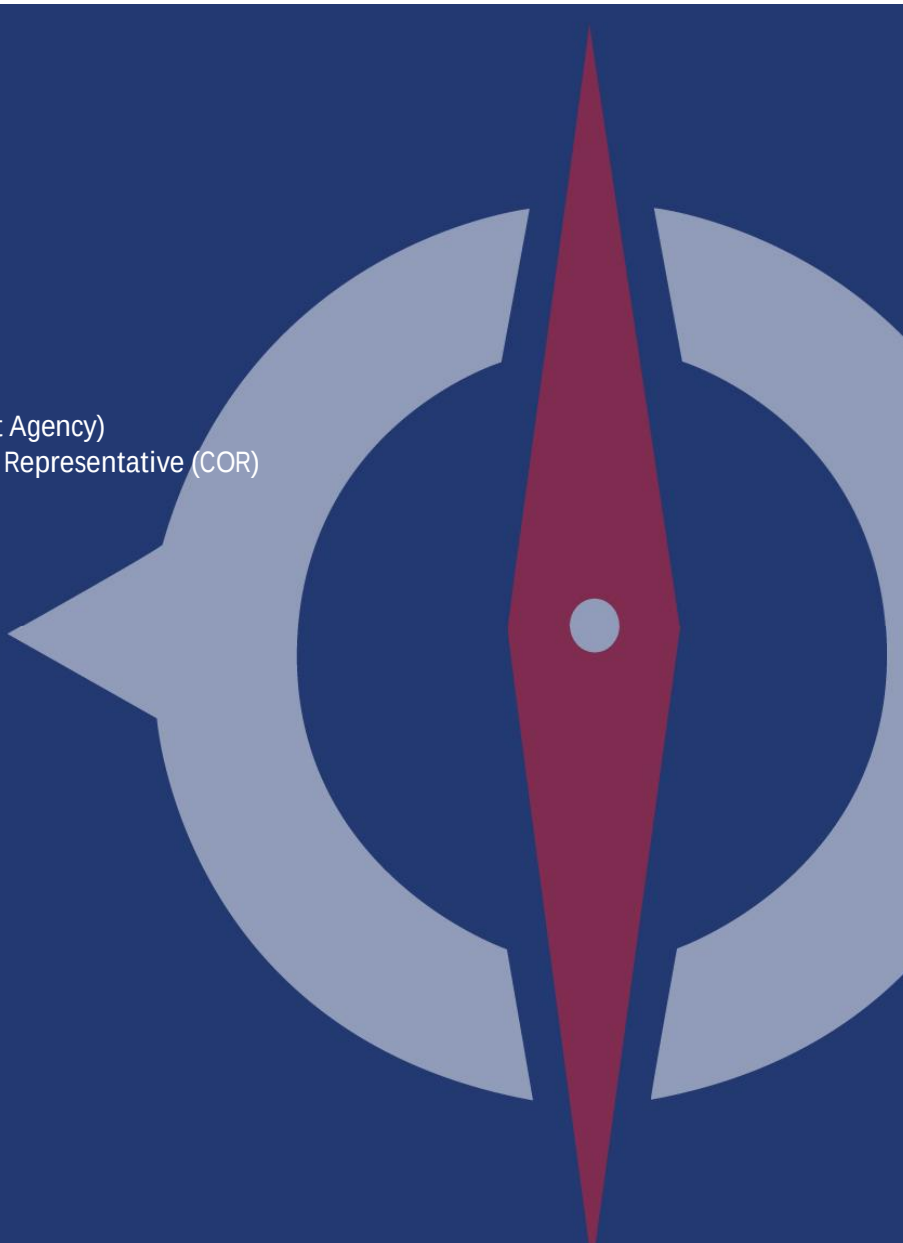

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DOCUMENT HISTORY

DOCUMENT LOCATION

K:/FY2020/20-06-0051S/Hydraulics|Toledo Bend LA| BLE 03

REVISION HISTORY

Version Number	Version Date	Summary Changes	Team/Author
1.0	November 2020	Initial Draft	AECOM

APPROVALS

This document requires the approval of the following persons:

Role	Name	Review Date	Approved Date
Project Manager	Elizabeth Levitz	November 30, 2020	November 30, 2020

CLIENT DISTRIBUTION

Name	Title/Organization	Location
FEMA's MIP	Region VI	See path above
Shona Gibson	FEMA Region VI	Denton, Texas

Table of Contents

Executive Summary i

Base Level Engineering (BLE) Methodology 1

1.1 Topographic Data 3
1.1.1 Source Terrain Data 3
1.1.2 Terrain Data Processing 5
1.2 Hydrology 5
1.2.1 Regression Analysis 7
1.2.2 Stream Gage Analysis 9
1.3 Hydraulics 12
1.4 Quality Control 15
1.5 One-percent Special Flood Hazard Area Delineation 16

Challenges 16

Results and Recommendations 18

3.1 CNMS Validation of Effective Zone A SFHA 18
3.2 Flood Risk Analysis 24

References 25

Appendix A BLE Map A-1

Executive Summary

FEMA Region VI contracted Compass to complete a Base Level Engineering (BLE) analysis for the Toledo Bend HUC-8 at the Texas/Louisiana border, to support FEMA's Discovery process and validation of effective Zone A Special Flood Hazard Areas (SFHAs). This BLE study will provide significant data for several Texas counties previously lacking modernized flood models.

The BLE process involves using best available data and incorporating automated techniques with traditional model development procedures to produce regulatory-quality flood hazard boundaries for the 1-percent annual chance event as well as estimates of flood hazard boundaries for multiple recurrence intervals.

The source digital terrain data used for surface model development in support of hydrologic and hydraulic analysis as well as mapping activities were leveraged from various local, State, and Federal partners. Details regarding the different datasets used are provided below in Section 1.1.

Flood discharges in Texas for this study were calculated using both the United States Geological Survey (USGS) regression equations and gage analysis, where stream gages with sufficient record exist. Regression equations were obtained from the USGS Scientific Investigations Report (SIR) 2009-5087, *Regression Equations for Estimation of Annual Peak-Streamflow Frequency for Undeveloped Watersheds in Texas Using an L-moment Based, PRESS-Minimized, Residual-Adjusted Approach* (2009). For flood discharges in Louisiana, regression equations were obtained from the USGS Fact Sheet 099-01, *Methods for Estimating Flood Magnitude and Frequency in Rural Areas in Louisiana* (2001).

The Hydrologic Engineering Center's River Analysis System (HEC-RAS) program version 5.0.5 was used to compute water surface elevations on a stream by stream basis. All hydraulic models were computed using 1-D steady state analysis.

The stream mile network that was validated for these watersheds was compiled using FEMA's Community Needs Management Strategy (CNMS) inventory. CNMS is an inventory of flood hazard studies and flood hazard mapping needs for areas where a study is needed. This data is helpful for community officials in analyzing and depicting flood hazards to enhance the understanding of flood risks. Communities may use this information to make informed decisions on their planning and flood mitigation efforts. Table ES-1 lists the Zone A stream miles associated with this validation analysis.

Table ES-1: Summary of Stream Miles

Source	Toledo Bend Stream Miles
CNMS	1,368.4

The full inventory of Zone A studies in the watershed were classified in CNMS. Total miles validated in CNMS are summarized in Table ES-2 and illustrated in Figure ES-1 below.

Table ES-2: Zone A Validation Results

Validation Status	Status Type	Total Miles
VALID	BEING STUDIED	21.9
UNVERIFIED	BEING STUDIED	1,346.4

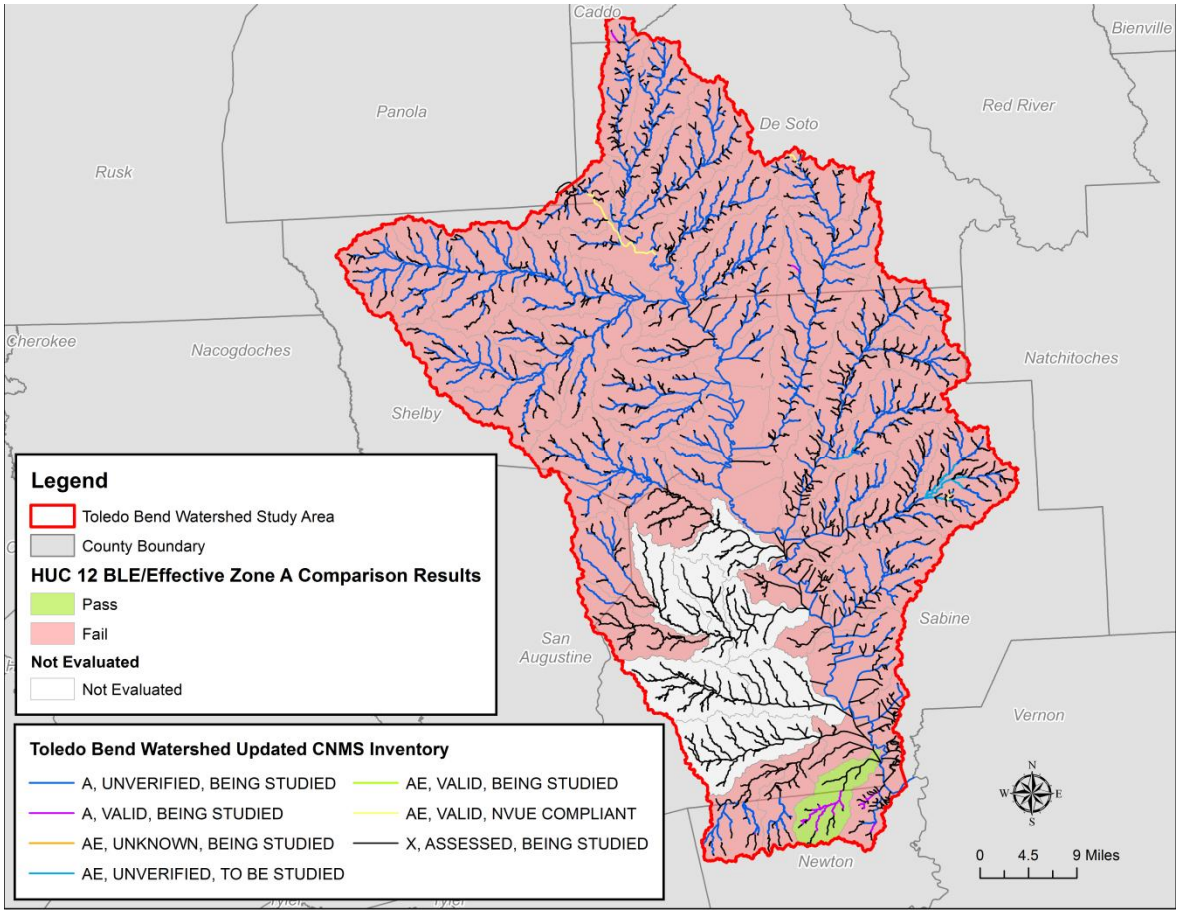

Figure ES-1: Toledo Bend Watershed CNMS Validation Results

An overall risk for each HUC-12 watershed was calculated using the National Flood Risk Percentages Dataset and its proportional area. The weighted risk was multiplied by the percentage of points in the watershed that failed the CNMS comparison to effective to determine the priority score. Figure ES-2 below shows the range of the Toledo Bend HUC-8 priority scores which can be used to initiate discussions during the Discovery phase.

Smith Creek-Flat Fork Creek HUC-12 was determined to have the highest priority score and the most need while Mill Creek-Toledo Bend Reservoir HUC-12 had the lowest scores.

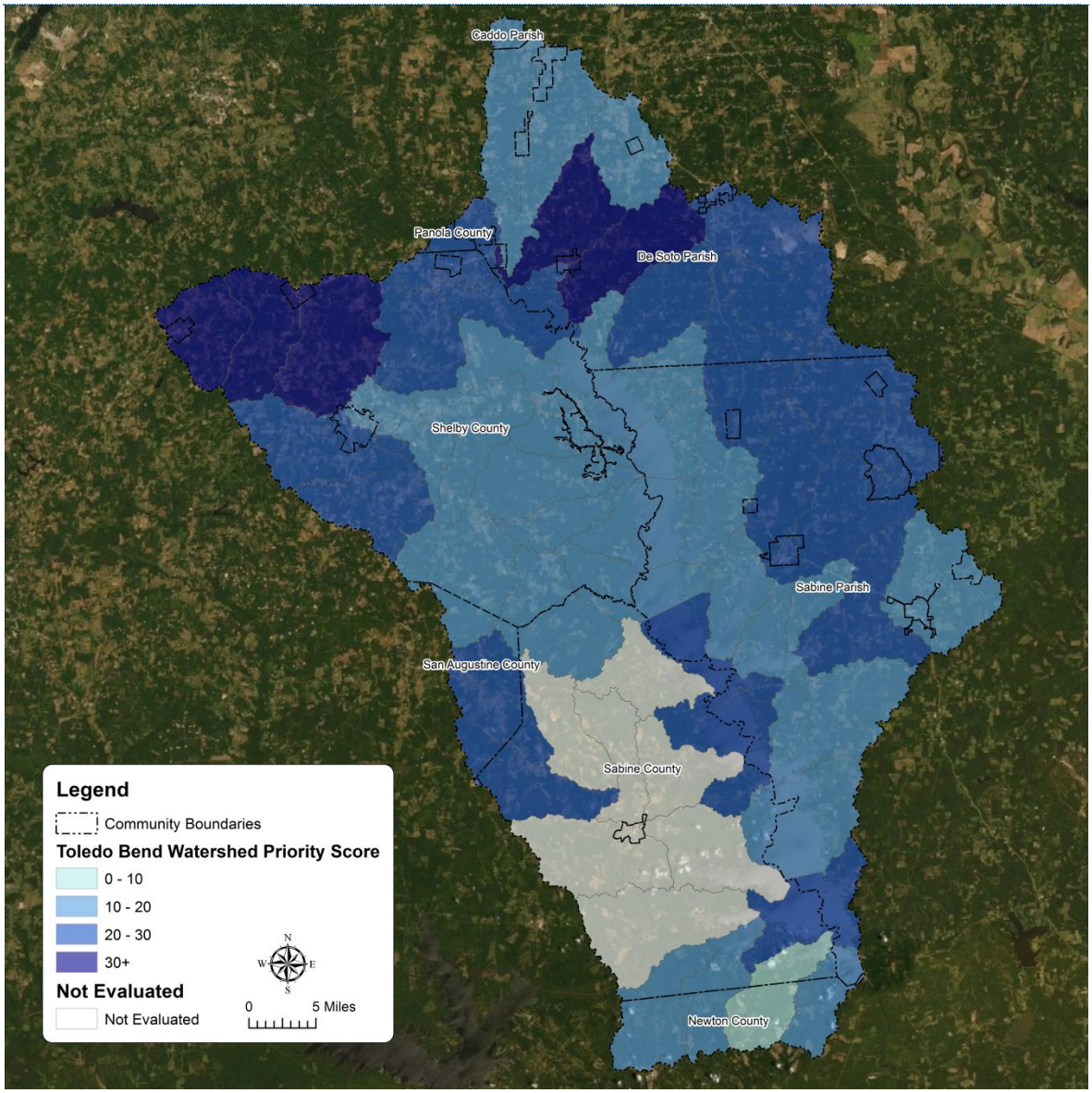

Figure ES-2: Ranking of Toledo Bend Watershed HUC-12s

Base Level Engineering (BLE) Methodology

Recent innovations and efficiencies in floodplain mapping have allowed the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) to develop a process called Base Level Engineering (BLE), which can be used to address current program challenges, including the validation of Zone A studies and the availability of flood risk data in the early stages of a Flood Risk Project. The BLE process involves using best available data and incorporating automated techniques with traditional model development procedures to produce regulatory quality flood hazard boundaries for the 1-percent annual chance event as well as estimates of flood hazard boundaries for multiple recurrence intervals. The cost for developing the data and estimates resulting from the BLE process are lower than standard flood production costs. The BLE results may be used for eventual production of regulatory and non-regulatory products.

As described in Title 42 of the Code of Federal Regulations, Chapter III, Section 4101(e), once every five years, FEMA must evaluate whether the information on Flood Insurance Rate Maps (FIRMs) reflects the current risks in flood-prone areas. FEMA makes this determination of flood hazard data validity by examining flood study attributes and change characteristics, as specified in the Validation Checklist of the Coordinated Needs Management Strategy (CNMS) Technical Reference. The CNMS Validation Checklist provides a series of critical and secondary checks to determine the validity of flood hazard areas studied by detailed methods (e.g., Zone AE, AH, or AO). While the critical and secondary elements in CNMS provide a comprehensive method of evaluating the validity of Zone AE studies, a cost-effective approach for evaluating Zone A studies has been lacking.

In addition to the need for Zone A validation guidance, FEMA standards require flood risk data to be provided in the early stages of a Flood Risk Project. FEMA Program Standard SID #29 requires that during Discovery, data must be identified that illustrates potential changes in flood elevation and mapping that may result from the proposed project scope. If available data does not clearly illustrate the likely changes, an analysis is required that estimates the likely changes. This data and any associated analyses should be shared and results should be discussed with stakeholders.

An important goal of the BLE process is the scalability of the results. Scalability means that the results of a BLE analysis can not only be used for CNMS evaluations of Zone A studies, but can also be leveraged throughout the Risk MAP program. The data resulting from a BLE analysis can be updated as needed and used for the eventual production of regulatory and non-regulatory products, outreach and risk communication, and MT-1 processing. Leveraging this data outside the Risk MAP program may also be valuable to external stakeholders.

FEMA Region VI contracted Compass to complete a BLE analysis for the Toledo Bend Watershed in Eastern Texas and Western Louisiana to support FEMA's Discovery process and validation of effective Zone A Special Flood Hazard Areas (SFHA). The study extents include portions of Caddo, De Soto, Natchitoches, Newton, Panola, Sabine, San Augustine, and Shelby Counties, and include the following communities: the City of Center, Hemphill, Huxley, Joaquin, Town of Keachi, Logansport, Many, Zwolle, Village of Converse, Grand Cane, Longstreet, Noble, Pleasant hill, South Mansfield, and Stanley. The study area consists of eleven HUC-10 basins: Bayou La Nana, Bayou San Patricio, Bayou Siep-Toledo Bend Reservoir, Flat Fork Creek, Grand Cane Bayou-Toledo Bend Reservoir, Housen Bayou-Toledo Bend Reservoir, Palo Gaucho Bayou, Patroon Bayou, San Miguel Bayou, Sixmile Creek-Toledo Bend Bayou, and Tenaha Creek. Figure 1 shows the orientation of the Toledo Bend Watershed HUC-10 basins with respect to the counties.

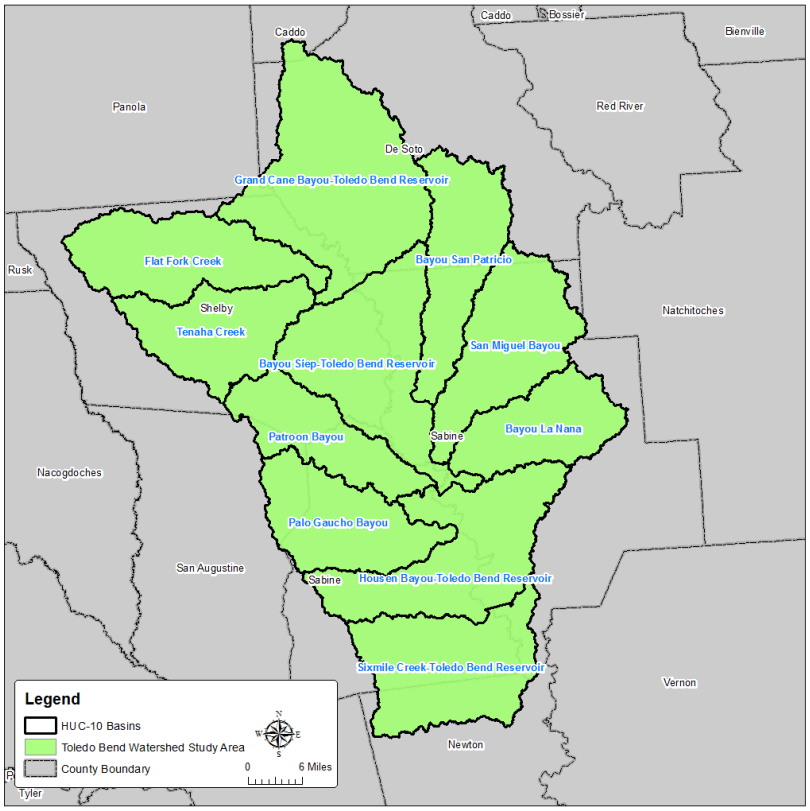

Figure 1: Toledo Bend Watershed HUC-10 Basins

AECOM studied approximately 3,260 miles of stream reaches within the Toledo Bend Watershed with a minimum drainage area tolerance of one square mile outside of population centers and half a square mile inside population centers. The selection and extent of stream reaches studied were based upon the number of stream miles with a minimum drainage area of one square mile and not the number of effective Zone A stream miles. Study reaches were extended above this threshold as appropriate to ensure all effective Zone A flood areas received an updated analysis. Topographic data from multiple sources were used to determine the hydrologic and hydraulic characteristics of the watershed. The following sections summarize the BLE process and discuss the results along with their recommended use.

1.1 Topographic Data

Topographic data from multiple sources were used to determine the hydrologic and hydraulic characteristics of the watershed. Topographic data were obtained from the Texas Natural Resources Information System (TNRIS), and the United States Geological Survey (USGS).

All available metadata, survey reports, and other leverage documentation are available with the source dataset. Figure 2 shows the extents of the source Digital Terrain Model (DTM) data used for the Toledo Bend Watershed.

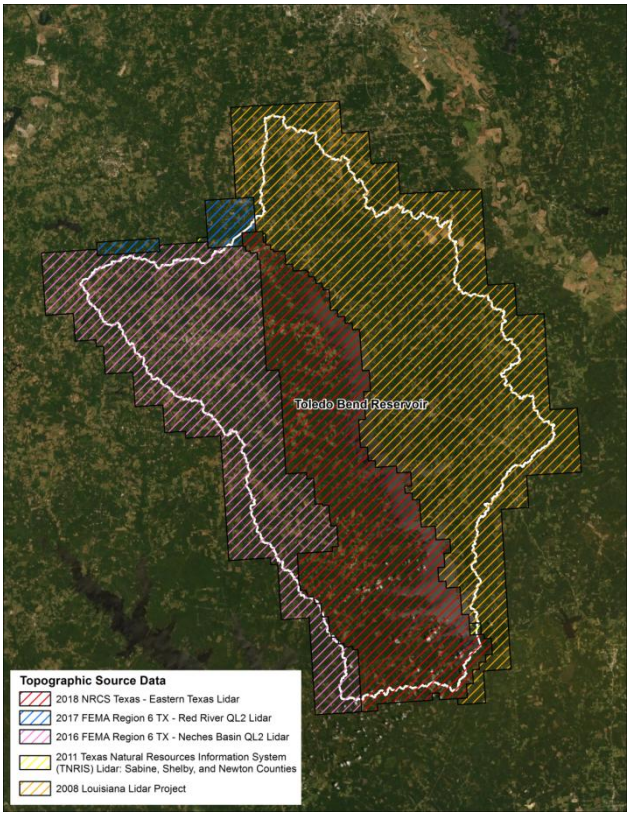

Figure 2: Extent of LiDAR Data for Toledo Bend Watershed

1.1.1 Source Terrain Data

Five topographic datasets were used in the development of the BLE hydraulic models. Details on each dataset are outlined below.

1.1.1.1 2018 NRCS Texas – Easter Texas LiDAR

The 2018 NRCS Texas – Eastern Texas LiDAR was acquired from the United States Geological Survey (USGS). Data was collected and processed by Digital Aerial Solutions (DAS), LLC. The LiDAR data was collected from March 6th to March 21st of 2018. This task order requires LiDAR data to be acquired over approximately 5,577 square miles of LiDAR affecting Leon, Washington, Sabine, San Jacinto, Shelby, Grimes, Lee, Madison, Milam, Trinity and Newton Counties in Texas. The LiDAR was collected at a nominal pulse spacing (NPS) of 0.7 meters. The LiDAR data was acquired

and processed in compliance with USGS National Geospatial Program LiDAR Base Specification version 1.2. The Root Mean Square Error (RMSE)z reported for the dataset was 5.1 cm at the 95% confidence level which meets project accuracy specifications of the National Standard for Spatial Data Accuracy (NSSDA).

1.1.1.2 2017 FEMA Region 6 TX – Red River QL2 LiDAR

This USGS LiDAR collection covers portions of Lamar, Red River, Bowie, Franklin, Titus, Morris, Cass, Camp, Wood, Upshur, Marion, Gregg, Smith, Harrison, Rusk, Panola, and Hopkins Counties, Texas. The primary purpose of this project was to develop a consistent and accurate surface elevation dataset derived from high-accuracy LiDAR technology for the Texas Red River FEMA R6 Project Area. The LiDAR data were processed and classified according to project specifications. Detailed breaklines and bare-earth DEMs were produced for the project area. Data was formatted according to tiles with each tile covering an area of 1500m by 1500m. A total of 10,138 tiles were produced for the project encompassing an area of approximately 8,587 sq. miles.

Dewberry served as the prime contractor for the project. In addition to project management, Dewberry was responsible for LAS classification, all LiDAR products, breakline production, DEM production, and quality assurance. Quantum Spatial and Precision Aerial Reconnaissance completed LiDAR data acquisition and data calibration for the project area. Kinetics completed some breakline production in a portion of TX Red River FEMA R6 LiDAR Project. Dewberry was responsible for all QA/QC of the final deliverables. Data acquisition occurred January 20, 2017 through March 1, 2017. The project was funded by FEMA to assist with hydrologic studies and hydraulic analysis to determine the risk of flood hazards.

1.1.1.3 2016 FEMA Region 6 TX – Neches Basin QL2 LiDAR

This USGS LiDAR project was conducted to capture the Neches river basin in East Texas. The project area falls within the Texas counties of Kaufman, Navarro, Freestone, Leon, Madison, Van Zandt, Henderson, Smith, Anderson, Cherokee, Rusk, Shelby, Nacogdoches, Houston, Trinity, Angelina, San Augustine, Sabine, Newton, Jasper, Tyler, Hardin, Polk, Liberty, Jefferson and Orange. The LiDAR data were processed and classified according to project specifications. Detailed breaklines and bare-earth DEMs were produced for the project area. Data was formatted according to tiles with each tile covering an area of 1500m by 1500m. The Texas Neches area of interest covers approximately 14,148 square miles and an additional 89 square miles of Texas Red River was added to the Texas Neches LiDAR project. A total of 16,796 tiles were produced for the project encompassing an area of approximately 14,237 sq. miles.

Dewberry served as the prime contractor for the project. In addition to project management, Dewberry was responsible for LAS classification, all LiDAR products, breakline production, DEM production, and quality assurance. Quantum Spatial, Inc (Quantum Spatial) and Precision Aerial Reconnaissance (PAR) completed LiDAR data acquisition and data calibration for the project area.

The date of the acquisition spanned two years. Collection in 2016 was flown March 3, 2016 through March 5, 2016. Collection in 2017 was flown January 25, 2017 through February 22, 2017. A reflight occurred on October 9, 2017. The LiDAR data was acquired and post-processed by Quantum Spatial and Dewberry. The purpose of this project was to produce high accuracy 3D elevation products for the region which previously did not have any LiDAR data.

1.1.1.4 2011 Texas Natural Resources Information System (TNRIS) LiDAR: Sabine, Shelby, and Newton Counties

This StratMap LiDAR collection covers portions of Sabine, Shelby and Newton Counties in East Texas. Aerial collection took place from January 12 to February 13, 2011 by MJ Harden (now PhotoScience) and Dewberry provided third-party quality assurance and quality control (QA/QC). The project was funded through collaboration between the TNRIS and the Sabine River Authority (SRA). This project was procured through the Council on Competitive Government's High Priority Imagery and Datasets (HPIDS) contract. The area of interest was selected based on statewide prioritization of floodplain mapping needs and in coordination with SRA.

1.1.1.5 2008 Louisiana LiDAR Project

Begun in 2000, Louisiana's statewide LIDAR project was initiated in response to the high per capita and repetitive flood loss rates experienced by the FEMA, National Flood Insurance Program and the private insurance industry in the state. LIDAR derived, high-resolution topographic information has been accepted by FEMA as a low cost means to update inaccurate and out of date flood maps. The state sponsor for the project, thus far, has been the Louisiana Oil Spill Coordinators Office (LOSCO), which has managed the project and arranged for state match through legislative action. Oil spill contingency planning and response issues plague all Louisiana parishes requiring critical high resolution topographic information. The Louisiana Office of Emergency Preparedness (OEP) has recently assumed administrative control of the project, largely because of OEP's direct, official connection with FEMA. The LIDAR systems being used in the Louisiana project are accurate to 15- 30 cm RMSE, depending upon land cover, and will support contours of 1'-2' vertical map accuracy standards. The task areas included in this area fall within 8.81 - 15.94 cm RMSE. These accuracies meet FEMA standards for floodplain reevaluation studies and map modernization programs designed to update the Flood Insurance Rate Maps (FIRM).

1.1.2 Terrain Data Processing

The LiDAR data were processed in Environmental System Research Institute (ESRI) ArcGIS software to create a composite DTM dataset for the project area. The outputs from the processing described below were used during the hydrology, hydraulics, floodplain mapping and CNMS processes and validations.

The Watershed Information System (WISE) software platform was utilized in order to create a digital surface model for the Toledo Bend Reservoir project area. This module allows source data from a variety of sources to be prioritized based on level of accuracy or preference of the user. The 2018 NRCS Texas - Eastern Texas LiDAR dataset was prioritized as the best data source for the Toledo Bend Reservoir Watershed followed by the 2017 FEMA Region 6 TX - Red River QL2 LiDAR, 2016 FEMA Region 6 TX - Neches Basin QL2 LiDAR, 2011 TNRIS LiDAR: Sabine, Shelby, and Newton Counties, and 2008 Louisiana LiDAR Project.

The 10-foot DEMs created from the LiDAR datasets described above were compiled in order of vertical accuracy into a mosaic dataset using ArcMap. The normal pool elevation for the Toledo Bend reservoir was determined to be 171.75 feet. The reservoir is not always constant, so another raster was created for the lake boundaries and given the highest priority in the mosaic dataset in order to override the LiDAR datasets showing various elevations above and below normal pool. From this mosaic, a tile index was created for the project area and the mosaic was

clipped into 40,000-foot tiles, converted to asciis and imported into Wise Terrain Analyst (WTA). Visual inspection of the 10-foot DEMs was performed to ensure no voids and/or artifacts were present. The DEM surface model was affirmed to be suitable for hydraulic takeoffs and supporting other hydraulic analyses.

Stream centerlines were manually digitized using the 10-foot DEMs as a source for horizontal alignment and vertical elevation. These stream centerlines are created for use in the hydraulic analysis-and hydro-enforcement of the 50-foot DEMs. Several routines were then used to take localized elevations from the source topographic data and apply them to the streams. This gave the stream vertices elevation information along the Z axis. The resulting elevations ensure that the streams are lower in elevation than any overbank sumps. A separate routine was then used to ensure that the elevations of these vertices descend in height down to an outfall. The final streams file is then "burned" into the 50-foot DEMs to force flow through structures while preventing it from jumping out of the channel banks.

After the DEM was imported, an additional 50-foot DEM was created from the same mosaic and tile index used for the 10-ft DEM. This 50-foot DEM was used for hydro enforcement of the project area. Proprietary software was used to identify natural sinks, peaks and flat areas in the 50-foot DEM surface. Elevations of the cells in the DEM were algorithmically calculated and the best path to route flow was determined without filling sinks in the DEM. Once all calculations were completed, the flow was checked confirming that all drainage flowed downstream correctly and routed to outside of the project area.

In addition to the quantitative assessment of the source digital terrain, a qualitative visual inspection of the composite DEM was performed using a hillshade derived from the 10-foot DEM. The visual inspection indicated no unusual or non-terrestrial features were observed in the composite DEM assuring the surface files used for hydrologic and hydraulic analyses and floodplain mapping activities are sufficient for BLE analysis.

1.2 Hydrology

Flood discharges for this study were calculated using both the USGS regression equations and gage analysis, where stream gages with sufficient record exist. Regression equations obtained from the USGS Scientific Investigations Report (SIR) 2009-5087, *Regression Equations for Estimation of Annual Peak-Streamflow Frequency for Undeveloped Watersheds in Texas Using an L-moment Based, PRESS-Minimized, Residual-Adjusted Approach* (2009) contain the most recent regression equations for Texas. For Louisiana, regression equations were obtained from the USGS Fact Sheet 099-01, *Methods for Estimating Flood Magnitude and Frequency in Rural Areas in Louisiana* (2001). Although some HUC-10 boundaries (Grand Cane Bayou, Bayou Siep, Housen Bayou, and Sixmile Creek) include reaches in both Louisiana and Texas, the respective regression equations were used for the basins and reaches existing in each state. There were no instances of a studied reach utilizing both Texas and Louisiana regression equations due to the Sabine River/Toledo Bend Reservoir flowing along the state boundary. There are differences in the parameters used in the Texas and Louisiana regression equations discussed in the following sections. USGS Peak FQ Version 7.3 was used to perform the Flood Frequency Analysis (FFA) for the twenty gages within the Toledo Bend Watershed (see below for further discussion).

1.2.1 Regression Analysis

The WISE software was used to delineate drainage basins in shapefile format using the 50-foot DEM. WISE was also used to calculate the main-channel slope for each basin. The basin shapefile attribution was automated by WISE with drainage area, main-channel slope, precipitation, and OmegaEM, all inputs for the USGS regression equations.

Table 1 shows the published equations used in this study for Texas. In these equations, Q_i represents peak streamflow for i-recurrence interval (annual chance exceedance (a.c.e.)) in cubic feet per second (cfs), P represents mean annual precipitation in inches, S represents dimensionless main-channel slope, Ω represents the OmegaEM parameter, and A represents cumulative drainage area in square miles.

Table 1: Summary of Regression Equations in Texas (SIR 2009-5087)

Recurrence Interval	Equation
$Q_{10\%}$	$P^{1.203} \times S^{0.403} \times 10^{[0.918\Omega + 13.62 - 11.97A^{(-0.0289)}]}$
$Q_{4\%}$	$P^{1.140} \times S^{0.446} \times 10^{[0.945\Omega + 11.79 - 9.819A^{(-0.0374)}]}$
$Q_{2\%}$	$P^{1.105} \times S^{0.476} \times 10^{[0.961\Omega + 11.17 - 8.997A^{(-0.0424)}]}$
$Q_{1\%}$	$P^{1.071} \times S^{0.507} \times 10^{[0.969\Omega + 10.82 - 8.448A^{(-0.0467)}]}$
$Q_{0.2\%}$	$P^{0.988} \times S^{0.569} \times 10^{[0.976\Omega + 10.40 - 7.605A^{(-0.0554)}]}$
Variables: Q_i, peak flow for i recurrence interval (a.c.e.), in cubic feet per second; P, mean annual precipitation, in inches; S, Main-channel slope (dimensionless); Ω, OmegaEM parameter; A, cumulative drainage area, in square miles	

Discharges for the 1-percent plus and 1-percent minus a.c.e. were calculated as well. These values were computed as $Q_{1\%+/-} = Q_{1\%} \pm 10^{1.6*0.30}$, where 0.30 is the mean residual standard error for the $Q_{1\%}$ equation.

The mean annual precipitation values were determined based on a shapefile coverage obtained from the TWDB and is available for download at the following location: https://www.twdb.texas.gov/mapping/gisdata.asp

The annual precipitation values reflect data for the climatological period 1981-2010 as recorded by the Natural Resources Conservation Service (NRCS).

Main-channel slope was calculated in WISE. An automated routine determined the longest flowpath from upstream of a reach to the outlet of the sub-basin of interest. Two points along the channel, one at 0 percent and the other at 100 percent of the channel length, determined the endpoints of the segment used in the main-channel slope calculation. The elevations for those endpoints were based on the 10-foot DEM developed from the LiDAR.

From SIR 2009-5087, the OmegaEM parameter is a generalized terrain and climate index that expresses relative differences in peak-streamflow potential. A shapefile was developed and populated with OmegaEM values based on Figure 2 in SIR 2009-5087. This shapefile was used to determine OmegaEM values on a sub-basin basis. For sub-basins spanning more than one OmegaEM grid, the sub-basin's centroid determined its OmegaEM parameter.

Table 2 shows the published equations used in this study for Louisiana. The study area is within the Pine hills physiographic region. In these equations, Q_i represents peak streamflow for i-recurrence interval (annual chance exceedance (a.c.e.)) in cubic feet per second (cfs), AP represents mean annual precipitation in inches, SLP represents channel slope channel slope measured between two points along the main channel, one at 10% of the channel length and the other at 85% of the channel length, in feet per mile, and DA represents cumulative drainage area in square miles.

Table 2: Summary of Regression Equations in Louisiana (Pine Hills Region) (FS099-01)

Recurrence Interval	Equation
$Q_{10\%}$	$19.5DA^{0.768} \times SLP^{0.392} \times (AP-35)^{0.658}$
$Q_{4\%}$	$28.0DA^{0.778} \times SLP^{0.401} \times (AP-35)^{0.629}$
$Q_{2\%}$	$34.6DA^{0.785} \times SLP^{0.407} \times (AP-35)^{0.616}$
$Q_{1\%}$	$41.2DA^{0.791} \times SLP^{0.412} \times (AP-35)^{0.610}$
$Q_{0.2\%}$	$56.0DA^{0.803} \times SLP^{0.425} \times (AP-35)^{0.608}$
Variables: Q_i, peak flow for i recurrence interval (a.c.e.), in cubic feet per second; DA, cumulative drainage area, in square miles AP, mean annual precipitation, in inches; SLP, channel slope measured between two points along the main channel, one at 10% of the channel length and the other at 85% of the channel length, in feet per mile	

Discharges for the 1-percent plus and 1-percent minus a.c.e. were calculated as well. These values were computed as $Q_{1\%+/-} = Q_{1\%} \pm 10^{1.6*0.30}$, where 0.49 is the standard of error, in percent.

The annual precipitation values reflect data for the climatological period 1981-2010 as recorded by the PRISM Climate group.

Main-channel slope was calculated in WISE. An automated routine determined the longest flowpath from upstream of a reach to the outlet of the sub-basin of interest. Two points along the channel, one at 10 percent and the other at 85 percent of the channel length, determined the endpoints of the segment used in the main-channel slope calculation. The elevations for those endpoints were based on the 10-foot DEM developed from the LiDAR.

Drainage area for each sub-basin was determined based on automated basin delineations performed by WISE. Basin break points were set by the user with a sub-basin target size of one square mile. This criterion was adjusted for the main stem of the Toledo Bend River to avoid

excessive and unnecessary discharge breaks. Break points were also set immediately upstream of stream confluences. Cumulative drainage area was determined based on these automated delineations performed by WISE in combination with a stream connectivity routine that defined the stream reach segments with upstream and downstream neighbors.

The sub-basin shapefile was attributed with the computed regression discharges, and those discharges were incorporated into the Hydrologic Engineering Center's River Analysis System (HEC-RAS) models using an automated routine in WISE. Discharges, as well as water surface elevation results, were associated with the hydraulic cross-sections prior to generation of floodplain boundaries and grid mapping. Those results are available in GIS format as part of this BLE submittal package.

1.2.2 Stream Gage Analysis

Figure 3 shows the location of the twenty USGS stream gages on the Toledo Bend River mainstem used to develop weighted discharges for the study (Table 3). FFA were performed for all gages, according to USGS Bulletin 17C guidelines.

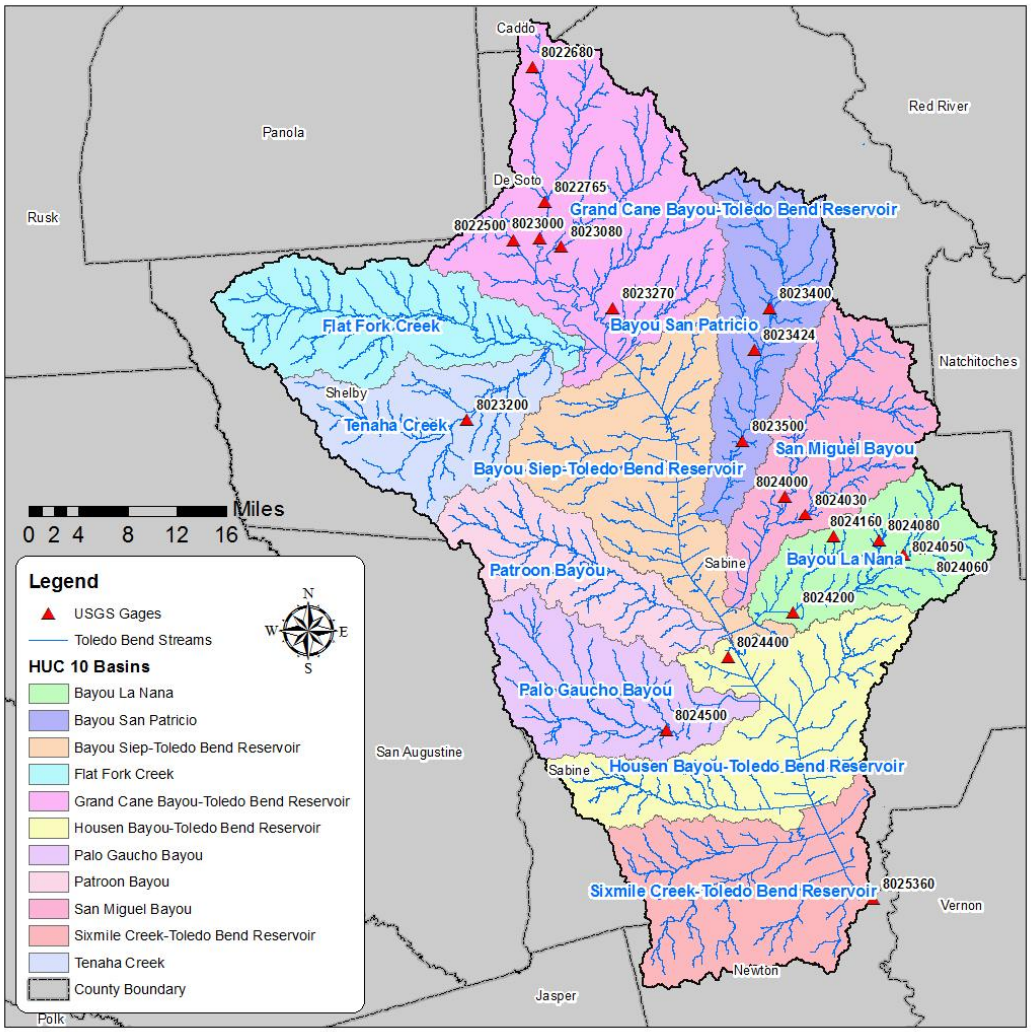

Figure 3: Locations of USGS Gages Utilized in Flood Frequency Analyses

Table 3: USGS Stream Gages in Toledo Bend Watershed

Gage ID	Flooding Source and Location	Computed Drainage Area (mi.^{2})	Published Drainage Area (mi.^{2})	Period of Record
08022765	Bayou Castor nr Funston, LA	90.1	91.5	1972-1986
08023000	Bayou Castor nr Logansport, LA	96.8	96.5	1955-1985
08023080	Bayou Grand Cane nr Stanley, LA	72.0	72.5	1981-2019
08024200	Bayou La Nana nr Zwolle, LA	130.1	130	1956-1966
08024000	Bayou San Miguel nr Zwolle, LA	113.2	111	1949-1967
08023400	Bayou San Patricio nr Benson, LA	80.6	80.2	1954-2019
08023500	Bayou San Patricio nr Noble, LA	154.1	154	1952-1967
08023424	Bayou San Patricio Trib No. 2 nr Converse, LA	1.0	0.9	1967-1981
08024030	Bayou Scie at Zwolle, LA	44.5	49.5	1950-2019
08024060	Blackwell Cr at Many, LA	3.5	3.2	1960-1983
08023270	Bull Bayou nr Hunter, LA	8.2	8.5	1964-1983
08022680	Bushneck Br Trib nr Keatchie, LA	1.0	1.2	1967-1981
08024050	Harpoon Bayou nr Many LA	23.3	22.7	1951-1968
08024160	Hurricane Creek Trib at Loring Lake nr Zwolle, LA	1.1	0.92	1954-1967
08024080	Lewis Creek nr Many, LA	12.8	12.5	1951-1965
08024500	Palo Gaucho Bayou nr Hemphill, TX	122.4	123	1952-1965
08022500	Sabine River at Logansport, LA	4,839	4,839	1884-2019
08025360	Sabine River at Toledo Bd Res nr Burkeville, TX	7,178	7,178	1972-2016
08024400	Sabine River nr Milam, TX	6,508	6,508	1924-1966
08023200	Tenaha Ck nr Shelbyville, TX	96.9	97.8	1952-1981

The flood flow frequency data from these gages were weighted with the regression developed discharges using the procedure described in SIR 2009-5087 and FS099-01. Adjusted discharges were held constant if the adjustment resulted in flows decreasing in the downstream direction.

Gage variances for each storm event were used to develop weighted discharges. These variances are provided in Table 4.

Table 4: Summary of Gage Variances Used

Gage ID	Variance				
	10PCT	4PCT	2PCT	1PCT	0.2PCT
08022765	0.0088	0.0125	0.0159	0.0199	0.0314
08023000	0.0072	0.0109	0.0145	0.0189	0.0321
08023080	0.0043	0.0065	0.0088	0.0116	0.0202
08024200	0.0194	0.0281	0.0360	0.0452	0.0708
08024000	0.0203	0.0298	0.0388	0.0495	0.0806
08023400	0.0042	0.0061	0.0083	0.0110	0.0198
08023500	0.0222	0.0322	0.0417	0.0527	0.0846
08023424	0.0222	0.0312	0.0399	0.0500	0.0789
08024030	0.0055	0.0083	0.0114	0.0153	0.0276
08024060	0.0036	0.0056	0.0074	0.0095	0.0154
08023270	0.0045	0.0065	0.0084	0.0106	0.0172
08022680	0.0178	0.0258	0.0333	0.0420	0.0670
08024050	0.0232	0.0342	0.0446	0.0568	0.0924
08024160	0.0124	0.0174	0.0222	0.0277	0.0436
08024080	0.0172	0.0251	0.0326	0.0412	0.0658
08024500	0.0229	0.0336	0.0436	0.0551	0.0882
08022500	0.0017	0.0022	0.0029	0.0039	0.0071
08025360	0.0061	0.0104	0.0154	0.0218	0.0430
08024400	0.0026	0.0036	0.0047	0.0062	0.109
08023200	0.0114	0.0172	0.0230	0.0299	0.0510

Weighted discharges were adjusted using a gage adjustment factor developed from a comparison between the rural and gage discharges and rounded to determine final discharges. Final discharges estimated by gage analysis adjustment, and used in the final BLE hydraulic models, are presented in Table 5.

Table 5: Final Discharges at USGS Stream Gages in Toledo Bend Watershed

Gage ID	10PCT (cfs)	4PCT (cfs)	2PCT (cfs)	1PCT (cfs)	0.2PCT (cfs)
08022765	5,760	8,020	9,880	11,770	16,850
08023000	5,350	7,750	9,790	11,980	18,070

Gage ID	10PCT (cfs)	4PCT (cfs)	2PCT (cfs)	1PCT (cfs)	0.2PCT (cfs)
08023080	8,390	11,480	14,070	16,980	24,680
08024200	8,620	12,890	16,590	20,600	32,180
08024000	9,870	15,180	19,940	25,700	41,950
08023400	10,380	15,160	19,300	24,050	36,930
08023500	8,950	13,770	18,040	22,980	36,930
08023424	510	760	980	1,230	1,910
08024030	9,410	14,700	19,550	25,460	42,600
08024060	930	1,200	1,410	1,620	2,180
08023270	740	1,020	1,230	1,430	1,980
08022680	220	350	450	560	890
08024050	6,980	10,550	13,840	18,180	30,360
08024160	500	680	830	990	1,410
08024080	2,280	3,360	4,280	5,350	8,300
08024500	9,360	14,600	19,500	25,300	42,800
08022500	39,400	53,500	64,900	77,000	108,000
08025360	75,400	115,000	152,000	195,000	328,000
08024400	50,600	66,700	79,700	93,300	128,000
08023200	10,000	15,800	21,100	27,400	46,800

A review of the stream gages with respect to Hurricane Harvey was performed to determine whether an additional adjustment factor would be appropriate. After the review, it was determined that the Hurricane Harvey event did not warrant an additional watershed adjustment factor. For Sabine River, only one gage had an annual max peak flow as a result of Harvey. The annual max peak flow associated with Harvey on 9/1/17 was 84,900 cfs. This was much less than the largest peak flow, 254,000 cfs, which occurred on 3/11/16. For the tributary gages, 3 stream gages had an annual max peak flow as a result of Harvey. However, all of these peaks were much less than their largest peak flow.

1.3 Hydraulics

The hydraulic approach for this BLE analysis of the Toledo Bend Watershed consisted of using the terrain model described in Section 1.1 in combination with the hydrologic outputs from Section 0 to establish water surface elevations using 1-D steady state analysis. HEC-RAS program version 5.0.5 was chosen as the computer model to compute water surface elevations on a stream by stream basis. The WISE software was used to establish model stream orientation, generate initial hydraulic cross section layout and stationing, assign n-values to cross-sections, and develop all

input files for the HEC-RAS program. ESRI's ArcGIS program was used to review and refine cross-section layout orientation.

First pass cross-section layout was performed using an automated routine in WISE that varies cross-section spacing based on the cumulative drainage area at the cross-section location. A first draft model was created based on this initial cross-section layout, and draft boundaries were developed. Next, a second pass inspection for cross-section placement and alignment occurred. Significant refinement occurred during this step. To improve the hydraulic models, additional cross-sections were added as needed to better define the BLE floodplain boundary. Cross-sections were extended in locations where overtopping occurred. Orientation of cross-sections was refined to improve on the perpendicular orientation to flow. Additional cross-sections were added at floodplain constrictions and at downstream portions of tributaries to ensure a proper tie-in with receiving streams. Cross-sections were adjusted to remove sections that intersected hydraulic crossings in the floodplain. For some of the largest studied streams, cross-sections were laid out manually in order to have more reasonable spacing and better capture the constrictions in the floodplain.

Cross-sections were not drawn on top of roadways or railroads but were placed at the upstream and downstream face of major roads and railroads. Ineffective flow stations were placed in the hydraulic models as appropriate to account for flow constrictions and other locations deemed by the engineer to be ineffective at conveying flow downstream.

Cross-sections were drawn on dam crests for dams with well-defined spillways in order to better represent ponded water upstream of the structures. In so doing, it was assumed that the vast majority of the flow during a flood event would pass the spillway and that the hydraulic model would reasonably estimate flow across the spillway as represented in the hydraulic cross-section. The elevations used in the modeling were checked against effective Zone A boundaries, and the results were deemed reasonable.

The relationship between cumulative drainage area and assigned channel geometry is shown in Table 6. These default values for dimensions and spacing were subject to change based on engineering judgment.

Table 6: Cross-Section Default Parameters

Drainage area (upper limit)	XS Spacing	Channel Top Width	Channel Bottom Width	Channel Depth
1	300	6	5	0.8
2	300	7	6	0.8
4	300	10	8	0.8
8	400	12	11	0.8
10	500	13	12	0.8
15	500	18	13	0.8
20	500	19	14	0.8
25	500	20	15	0.8
30	500	21	16	0.8
40	500	25	17	0.8
50	600	28	18	0.8
75	600	30	19	1
100	750	33	20	1
150	750	36	21	1

Drainage area (upper limit)	XS Spacing	Channel Top Width	Channel Bottom Width	Channel Depth
250	1,000	38	22	2
500	1,500	40	23	2
1,000	2,500	100	50	3
2,000	2,500	150	75	3
5,000	2,500	200	100	3

In typical BLE projects, Manning's roughness coefficients (n-values) are determined using the 2016 National Land Cover Data (NLCD) dataset in combination with n-values from Chow (1959) and Calenda et al. (2005). For this watershed, the n-values for the developed areas indicated an underestimation of the roughness coefficients when compared to the aerial imagery and were adjusted accordingly. The association between the n-values and the NLCD Classification is shown in Table 7. Manning's n-value takeoffs are performed by WISE (default values taken from the "Normal" column). N-values within channel banks are constrained by the automated routine to a range of 0.030 to 0.070. Then, overbank and channel n-values are manually adjusted in certain locations based on engineering judgment.

Table 7: Manning's "n" Roughness Based on 2016 NLCD Classification (Moore, 2011)

NLCD Classification	Selected Manning's n	Minimum	Normal	Maximum	Source
Open Water	0.033	0.025	0.03	0.033	Chow 1959
Developed, Open Space	0.04	0.01	0.013	0.016	Calenda et al. 2005
Developed, Low Intensity	0.08	0.038	0.05	0.063	Calenda et al. 2005
Developed, Medium Intensity	0.1	0.056	0.075	0.094	Calenda et al. 2005
Developed, High Intensity	0.15	0.075	0.1	0.125	Calenda et al. 2005
Barren Land	0.025	0.025	0.03	0.035	Chow 1959
Deciduous Forest	0.16	0.1	0.12	0.16	Chow 1959
Evergreen Forest	0.16	0.1	0.12	0.16	Chow 1959
Mixed Forest	0.16	0.1	0.12	0.16	Chow 1959
Scrub/Shrub	0.1	0.035	0.05	0.1	Chow 1959
Grassland/Herbaceous	0.035	0.025	0.03	0.035	Chow 1959
Pasture/Hay	0.03	0.03	0.04	0.05	Chow 1959
Cultivated Crops	0.035	0.025	0.035	0.045	Chow 1959
Woody Wetlands	0.12	0.08	0.1	0.12	Chow 1959
Emergent Herbaceous Wetland	0.07	0.07	0.1	0.15	Chow 1959

The downstream boundary condition used for the majority of the study streams was normal depth with a default value of 0.005 ft/ft. For streams with large drainage areas (generally greater than 8 square miles), the normal depth slope was calculated based on the channel inverts of the downstream cross-sections.

In cases where streams tie in to a lake, a normal depth slope was calculated based on the channel inverts of the downstream cross-sections (typically between 0.0001 and 0.001 ft/ft). Several HUC-

10s within this watershed are located in urban areas with storm drain systems, which are unaccounted for in the BLE models. Implications of these systems may considerably affect risk.

1.4 Quality Control

Following the initial hydraulic model analysis in each watershed, the resulting flood hazard area delineations were reviewed for areas where the results were not ideal.

QC results indicated that some of the models should be extended to cover the scope of effective flood hazard data. Those streams were extended farther upstream to match the extents of the effective SFHA data.

Typical revisions resulting from reasonability checks included adding cross-sections, adjusting orientation of cross-sections, trimming cross-sections and reduction of the default "V" angle of cross-sections. Examples of default "V" angled cross-sections are shown in Figure 4. It is estimated that 75 percent of cross-sections were adjusted in some work areas while other areas did not require as much editing. Other examples of manual editing included the addition of cross-sections at confluence areas (see Figure 5 below), modifications to improve perpendicular orientation at the channel, adjustment of discharge breaks to better represent flow addition points, revisions to cross-sections at dams, additional cross-sections bounding major hydraulic structures, and revisions to n-values.

A major component of the QC process was an automated check that identified locations where the 1-percent a.c.e profile was crossed by any other frequency profile. Significant effort was made to reasonably resolve all of these instances. Another automated check identified locations where there was a drawdown of greater than 0.5 foot on the 1-percent a.c.e. water surface profile. This check is particularly useful for identifying errors in the model such as a channel that is too wide, a poorly placed cross-section, or a need for additional cross-sections. Again, significant effort was made to reasonably resolve these drawdown situations.

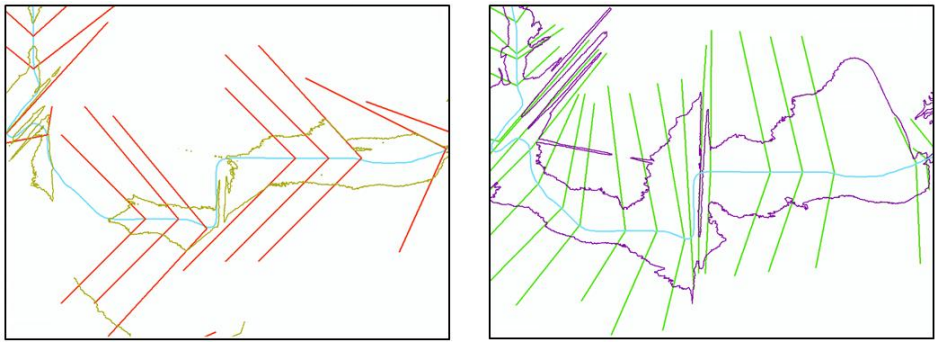

Figure 4: Default "V" angle cross-sections automated by WISE (left). Manually edited cross-sections to more accurately capture terrain (right). Resulting flood boundaries shown in gold (left) or purple (right) for clarity.

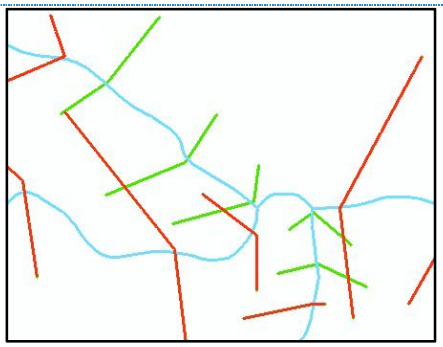

Figure 5: Manually added cross-sections (green) to improve accuracy of tie-ins at confluences.

1.5 One-percent Special Flood Hazard Area Delineation

The 1-percent and 0.2-percent boundaries were mapped using a routine that develops water surface elevation grids based on the 10-foot cell size DEM developed from the LiDAR dataset used for this project (see Section 1.1). This product was converted to a polygon for cleaning. The cleaning routine involved manual inspection of the polygons to identify and remove areas of disconnected flooding. In general, all polygons greater than 5,000 square feet are investigated, but all polygons, including those less than 5,000 square feet that intersect the stream line are included in the final output. This investigation was aided by the ground DEM and aerial imagery. Manual adjustments to the polygons were made to account for spillways on dams which could not be accurately modeled using HEC-RAS as well as disconnected areas along the flooding source that should reasonably be connected.

Following the removal of disconnected flooding areas and other boundary adjustments, the small islands in the floodplain were filled. In general, islands less than 2 acres were inspected and filled.

Once the island filling process was complete, the water surface raster mapping routine was run and set to conform to the polygon boundary. This ensures that the water surface raster and the floodplain boundary are consistent with each other. The depth raster product was created at the end of the process by performing a raster subtraction with the water surface elevation raster and the ground DEM.

Challenges

In Patroon Bayou, there is an overtopping issue on Bull Bay Creek just upstream of where Bull Bay Creek meets Patroon Bayou at station 5468. This is an issue for at 10YR WSELs and becomes more significant at 100YR and 500YR. At approximately station 3483 on Bull Bay Creek, there is a possibility of overtopping into UNT 058 in PCW to the north. This is a more minor overtopping issue and is only possible for 500YR flows.

In Bayou San Patricio, there were two streams with overtopping concern. At station 8026 on UNT 056 in BSP, overtopping is possible to the south into Bayou San Patricio with 10YR flows. On UNT 031 in BSP, overtopping is possible for 100YR and 500YR along State Route 513 to Bayou San Patricio. In several locations, obtaining precise flow values was difficult due to the shared floodplain of many of the streams along the Bayou San Patricio. This can be observed around station 135649 on Bayou San Patricio, where a XS crosses Bayou San Patricio, UNT 044 in BSP, Green Cane Bayou, and Stinkfinger Creek.

In Bayou Siep, there are several areas where new roads/new development has occurred since the LiDAR was flown. These areas occur at stations 18846 along Big Branch and 21450 along UNT 29 in BSP_LA.

In Tenaha Creek, there were several areas where obtaining precise flow/stage values was difficult due to shared floodplains of many streams. These areas were manually interpolated using in-house tools. These areas included Morrison Creek (station 3599), Porter Creek (station 4763), Tenaha Creek (station 104595), Town Creek (station 26379) and UNT 027 in TCW (station 9048).

In Palo Gaucho, there is a split flow near the confluence of Maddox Creek with Palo Gaucho Bayou. Further detailed analysis is suggested in this area to better understand the flooding impacts in this area

In Bayou La Nana, there was some difficulty with the tie in at Edmonson Creek and Bayou La Nana where the constrained raster editor had to be used. There is also a shared floodplain issue with Bayou La Nana and UNT 028 in Bayou La Nana where the main channel flow overtops into UNT 028 ahead of the junction.

In Housen Bayou, along Carrice Creek cross-sections were extended past the low lying area running parallel to the channel, this lead to a split in mapping suggesting a need for detailed study. Moreover, due to substantially high water surface elevations along Bayou Negreet, UNT 054 in HBW couldn't tie in, so detailed study is recommended. Right upstream of the confluence between Yocum Creek and UNT 040 in HBW, there is a small ditch/channel that connects the two streams. There is a significant difference in water surface elevations on both sides of the ditch; to further access flooding along this area detailed study is suggested.

In Grand Cane Bayou, cross-sections were clipped at basin extent for UNT 069 in GCBW due to overtopping, so detailed study is recommended.

In Flat Fork Creek Watershed, the confluence of Flat Fork Creek and Chicken Bayou may need further study as split area is located. Similarly, the area between UNT039 and UNT040 also has split overflow, thus further study is recommended.

In Six Mile Creek Watershed, Sixmile Creek stream may require further study as multiple cross-sections are overtopped. Cross-sections were clipped at the basin extent and further study is required.

In San Miguel Bayou Watershed, Little Bayou Scie and Bayou Scie may require further study as multiple cross-sections are overtopped. Cross-sections were clipped at the basin extent and further study is required.

Results and Recommendations

The BLE results for this study produced an SFHA that conforms to the existing topography and compares favorably with the effective SFHA. These boundaries provide an approximate SFHA in areas that have not been previously studied and therefore do not currently have an SFHA mapped. These results provide context for flood risk communication as part of the Discovery process, and should be verified through community work map meetings before being applied to a regulatory product.

A map showing the BLE results is included as Appendix A.

3.1 CNMS Validation of Effective Zone A SFHA

The inventory of Zone A studies (1,368.4 miles) in the Toledo Bend Watershed were classified in CNMS with validation status of "UNVERIFIED" (1,346.4 miles) or "VALID" (21.9 miles), and with status type of "BEING STUDIED." The following is a summary of the results of the CNMS validation assessment for the effective Zone A studies in the study area. Initial Assessment checks A1-A3 were evaluated for the CNMS inventory of Zone A studies.

INITIAL ASSESSMENT A1 – SIGNIFICANT TOPOGRAPHY UPDATE CHECK

This check involves determining whether a topographic data source is available that is significantly better than what was used for the effective Zone A modeling and mapping. For the study area in the Toledo Bend Watershed, the effective Zone A topographic data leveraged is old and likely consisted of USGS topographic maps for the majority of the watershed. The LiDAR sources discussed in section 1.1 are a significant improvement from the effective Zone A topographic source for most of the study area. Therefore, most reaches failed this check. The studies in Newton County, TX and Caddo Parish, LA utilized LiDAR in their effective studies though and, therefore, the reaches in these areas passed this check.

INITIAL ASSESSMENT A2 – CHECK FOR SIGNIFICANT HYDROLOGY CHANGES

This check involves first determining if regression equations were used for the effective study. Next, it must be determined whether new regression equations have become available from the USGS since the date of the effective Zone A study. If newer regression equations exist for the area of interest, then an engineer must determine whether these regression equations would significantly affect the 1-percent annual chance flow.

The hydrologic methods for the majority of Zone A study areas located in the Toledo Bend watershed are unknown and, therefore, pass this assessment check. The reaches in Newton County, TX and Caddo Parish, LA did use regression equations in their effective studies. In both instances, the newest equations available were used in those studies. For this reason, these reaches also PASS this check.

INITIAL ASSESSMENT A3 – CHECK FOR SIGNIFICANT DEVELOPMENT

This check involves using the National Urban Change Indicator (NUCI) dataset to assess increased urbanization in the watershed of the Zone A study. If the percentage of urban area within the HUC-12 watershed containing the effective Zone A study is 15% or more, and has increased by 50% or more since the effective analysis, the study would fail this check. Although the NUCI data

provide year-to-year changes in urbanization, the NLCD also is needed to establish a baseline of urban land cover for this analysis. The check for significant development in this watershed was completed by evaluating percentage of urban change at the HUC-12 level. The entire study area, except for reaches in Newton County, TX, is still classified as rural. The reaches in Newton County, TX are iHUC-12 watersheds that meet the urban threshold but they have not experienced a significant increase in urban area since the effective analysis was completed. Therefore, all reaches within the study area PASS this check. All of the initial assessment results are shown in Table 8.

Table 8: Zone A Initial Assessment Results

Assessment Check	Pass / Fail	Notes
A1 – Topography	Pass/Fail	LiDAR was used in the effective study/LiDAR sources available are a significant improvement from effective topography
A2 – Hydrology	Pass	Regression equations not known to be used in effective study OR No new equations have been published
A3 – Development	Pass	HUC-12 watershed does not meet urban threshold OR There has not been a significant increase in urban area

VALIDATION CHECK A4 – CHECK OF STUDIES BACKED BY TECHNICAL DATA

Zone A studies that pass all initial assessment checks described above may be categorized as "Valid" in the CNMS Inventory only if the effective Zone A study is supported by modeling or sound engineering judgment and all regulatory products are in agreement. If the effective Zone A study passes all initial assessment checks, but is not supported by modeling, or if the original engineering method used is unsupported or undocumented, a comparison of the BLE results and effective Zone A's is performed. Zone A studies in Newton County, TX and Caddo Parish, LA are model-backed studies and PASS this check. . All other Zone A studies within the Toledo Bend Watershed are not model-backed studies and FAIL this check.

VALIDATION CHECK A5 – COMPARISON OF BLE AND EFFECTIVE ZONE A

The BLE /effective Zone A comparison method leverages the existing Floodplain Boundary Standard (FBS) certification procedures described in FEMA SID 113, but with a slight modification. This modified FBS comparison approach uses the 1-percent plus and 1-percent minus flood profiles and horizontal and vertical tolerances described in FEMA's Automated Engineering guidance document dated May 2016. For the comparison of BLE and effective Zone A in the Toledo Bend study area, the following vertical and horizontal tolerances were used to conduct the modified FBS procedure. One point was placed every 200 feet along the floodplain boundaries for comparison.

- Vertical Tolerance: +/- 10 feet (one-half contour interval of assumed effective topographic source).
- Horizontal Tolerance: +/- 75 feet (standard horizontal tolerance for BLE comparison testing).

Comparison results for these streams were grouped at the HUC-12 level and are summarized in Table 9 to better understand the general health of the HUC-12 watershed, but the validation check was performed at the stream level. Streams where the percentage of passing FBS sample points is greater than or equal to 85% are marked as "Pass", otherwise they are marked as "Fail".

Table 9: BLE Comparison Results

HUC-12 Watershed		Total FBS points	Fail	Pass	%Pass	BLE Comparison Pass? (>85%)	Priority Score
Watershed Name	Watershed Number						
Toledo Bend Watershed	All Streams	76,891	32,254	44,637	58%	FAIL	
Ayers Branch-Toledo Bend Reservoir	120100040807	1,403	800	603	43%	FAIL	13.6
Bayou Siep	120100040803	1,545	715	830	54%	FAIL	25.0
Bear Creek-Bayou San Patricio	120100040403	1,955	1,022	933	48%	FAIL	14.9
Beauchamp Creek-Tenaha Creek	120100040104	1,588	823	765	48%	FAIL	24.4
Big Sandy Creek	120100041101	1,230	347	883	72%	FAIL	35.1
Blue Bayou	120100040802	817	385	432	53%	FAIL	15.9
Bull Bay Creek-Patroon Bayou	120100040702	914	421	493	54%	FAIL	32.3
Bushneck Bayou	120100040302	2,402	737	1,665	69%	FAIL	21.3
Canadian Bayou-Grand Cane	120100040305	2,249	1,003	1,246	55%	FAIL	19.4
Caney Branch-Flat Fork Creek	120100040205	1,103	481	622	56%	FAIL	14.3
Carrice Creek-Toledo Bend Reservoir	120100041002	1,618	912	706	44%	FAIL	19.9
Castor Bayou	120100040303	3,125	951	2,174	70%	FAIL	25.1
Chatman Bayou-Bayou San Patricio	120100040401	1,436	655	781	54%	FAIL	23.3
Chicken Bayou-Flat Fork Creek	120100040203	2,195	1,012	1,183	54%	FAIL	17.6
Choctaw Branch-San Miguel	120100040505	1,834	612	1,222	67%	FAIL	21.4
Clement Creek	120100040306	2,265	1,125	1,140	50%	FAIL	17.6
Cow Bayou	120100040308	2,007	854	1,153	57%	FAIL	23.6
Derby Branch-Bayou San	120100040404	1,944	868	1,076	55%	FAIL	24.8
Grannies Creek-Toledo Bend	120100040801	1,749	719	1,030	59%	FAIL	13.9
Harpoon Bayou	120100040601	1,157	447	710	61%	FAIL	11.7
Horsehead Creek-San Miguel	120100040504	1,641	823	818	50%	FAIL	16.4
Huana Creek	120100040101	1,975	822	1,153	58%	FAIL	4.7
Hurricane Creek	120100040602	708	249	459	65%	FAIL	13.6
Lewis Creek-Bayou La Nana	120100040603	1,760	755	1,005	57%	FAIL	25.0
Lick Creek-Patroon Bayou	120100040701	1,760	910	850	48%	FAIL	14.9
Lost Bayou-San Miguel Bayou	120100040502	1,404	664	740	53%	FAIL	24.4
Lows Creek-Toledo Bend Reservoir	120100041105	1,395	782	613	44%	FAIL	35.1
Martinez Bayou-Toledo Bend Reservoir	120100040806	1,339	520	819	61%	FAIL	15.9
McDonald Bayou-Toledo Bend Reservoir	120100040804	671	175	496	74%	FAIL	32.3
McGrue Creek-Toledo Bend Reservoir	120100040805	1,145	467	678	59%	FAIL	21.3
Mill Creek-Toledo Bend Reservoir	120100041104	1,038	60	978	94%	PASS	19.4

Morris Creek-Toledo Bend Reservoir	120100040301	1,128	500	628	56%	FAIL	22.9
Negreet Creek	120100041001	3,155	1,054	2,101	67%	FAIL	18.5
Pen Bayou-Toledo Bend Reservoir	120100040309	896	387	509	57%	FAIL	14.9
Plum Creek-Flat Fork Creek	120100040204	1,603	799	804	50%	FAIL	28.2
Porter Creek	120100040102	1,095	573	522	48%	FAIL	25.9
Prairie Creek-Tenaha Creek	120100040103	1,006	439	567	56%	FAIL	20.0
Ramsey Creek-Flat Fork Creek	120100040201	1,278	518	760	59%	FAIL	30.5
San Miguel Creek	120100040501	1,263	601	662	52%	FAIL	23.8
Scie Bayou	120100040503	1,857	878	979	53%	FAIL	22.6
Smith Creek-Flat Fork Creek	120100040202	1,436	681	755	53%	FAIL	38.2
South Prong Creek-Toledo Bend Reservoir	120100041102	507	156	351	69%	FAIL	17.4
South Prong Indian Creek-Toledo Bend Reservoir	120100041106	1,633	362	1,271	78%	FAIL	17.6
Spring Branch-Bayou La Nana	120100040604	2,265	657	1,608	71%	FAIL	12.6
Styles Creek-Toledo Bend	120100040307	1,290	774	516	40%	FAIL	27.0
Tebo Creek	120100040902	135	60	75	56%	FAIL	22.2
Tenmile Bayou-Bayou San	120100040402	1,713	770	943	55%	FAIL	22.5
Tiger Creek-Palo Gaucho Bayou	120100040901	1,212	566	646	53%	FAIL	23.3
Wallace Creek-Grand Cane	120100040304	1,472	403	1,069	73%	FAIL	15.0
Yocum Creek-Toledo Bend	120100041005	2,575	960	1,615	63%	FAIL	18.3

VALIDATION RESULTS

Based on the validation assessments and BLE comparison results described above, the CNMS inventory of Zone A studies in the Toledo Bend Watershed has been updated as summarized in Table 10 and illustrated in Figure 6 below.

Table 10: Zone A Validation Results

Validation Status	Status Type	Total Miles
VALID	BEING STUDIED	21.9
UNVERIFIED	BEING STUDIED	1,346.4

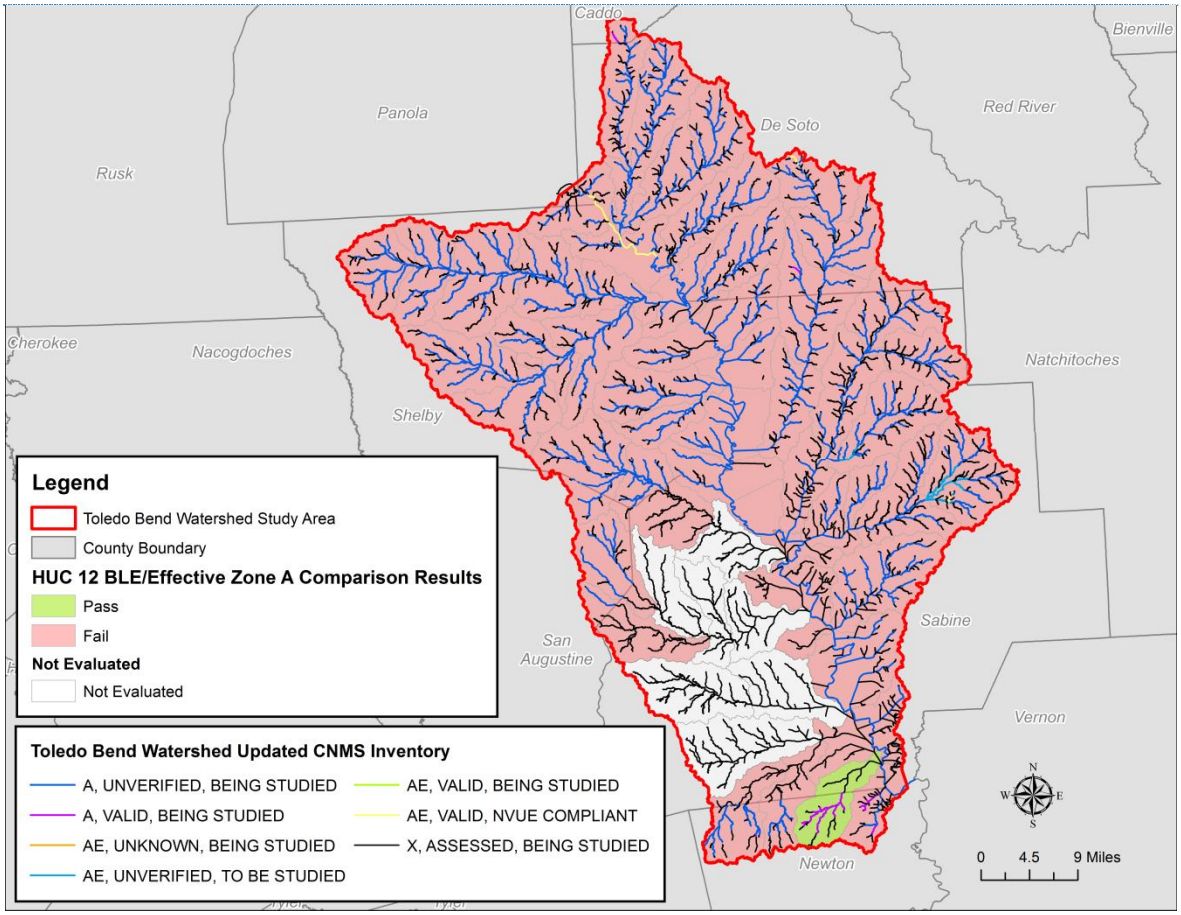

Figure 6: Toledo Bend Watershed CNMS Validation Results

An overall risk for each HUC-12 watershed was calculated using the National Flood Risk Percentages Dataset and its proportional area. The weighted risk was multiplied by the percentage of points in the watershed that failed the CNMS comparison to effective to determine the priority score. Figure 7 below shows the range of the HUC-12 priority scores which can be used to initiate discussions during the Discovery phase.

Smith Creek-Flat Fork Creek HUC-12 was determined to have the highest priority score and the most need while Mill Creek-Toledo Bend Reservoir HUC-12 had the lowest scores.

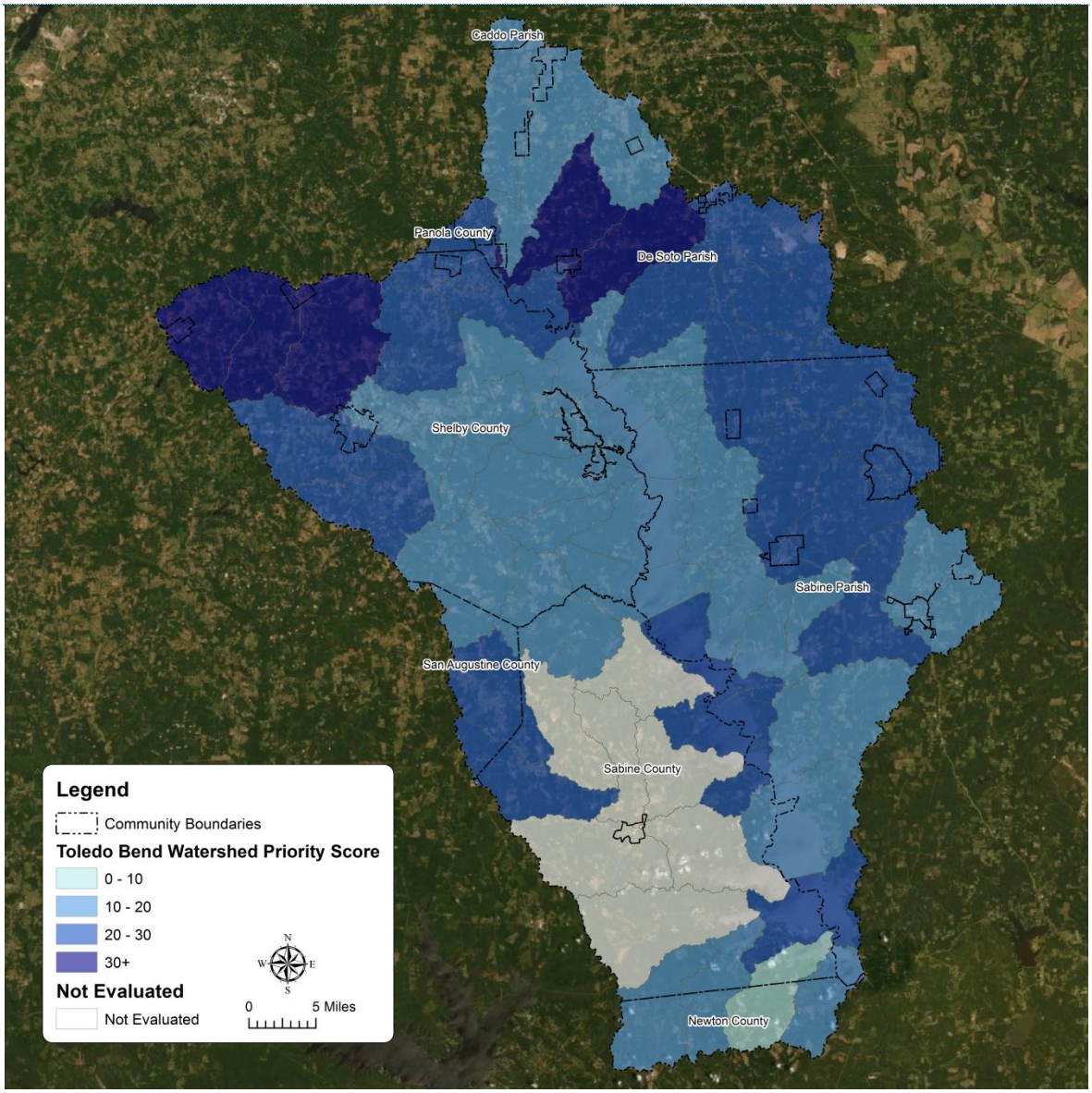

Figure 7: Ranking of Toledo Bend Watershed HUC-12s

3.2 Flood Risk Analysis

An advanced flood risk analysis was performed using the updated 1-percent-annual-chance grid (known as 'refined base level engineering grid") created for this project. The loss analysis uses 2010 census data and the subsequent results are stored in the L_RA_Results table.

Hazus version 4.2 was used for the loss analysis.

The losses are reported via census blocks. It is important to note that Hazus version 4.2 uses dasymetric census blocks. Dasymetric mapping removes undeveloped areas (such as areas covered by other bodies of water, wetlands, or forests) from the Census blocks, changing their shape and reducing their size in these areas. For more information on dasymetric data visit FEMA's Media Library for the Hazus-MH Data Inventories: Dasymetric vs. Homogenous, or Hazus 3.0 Dasymetric Data Overview.

References

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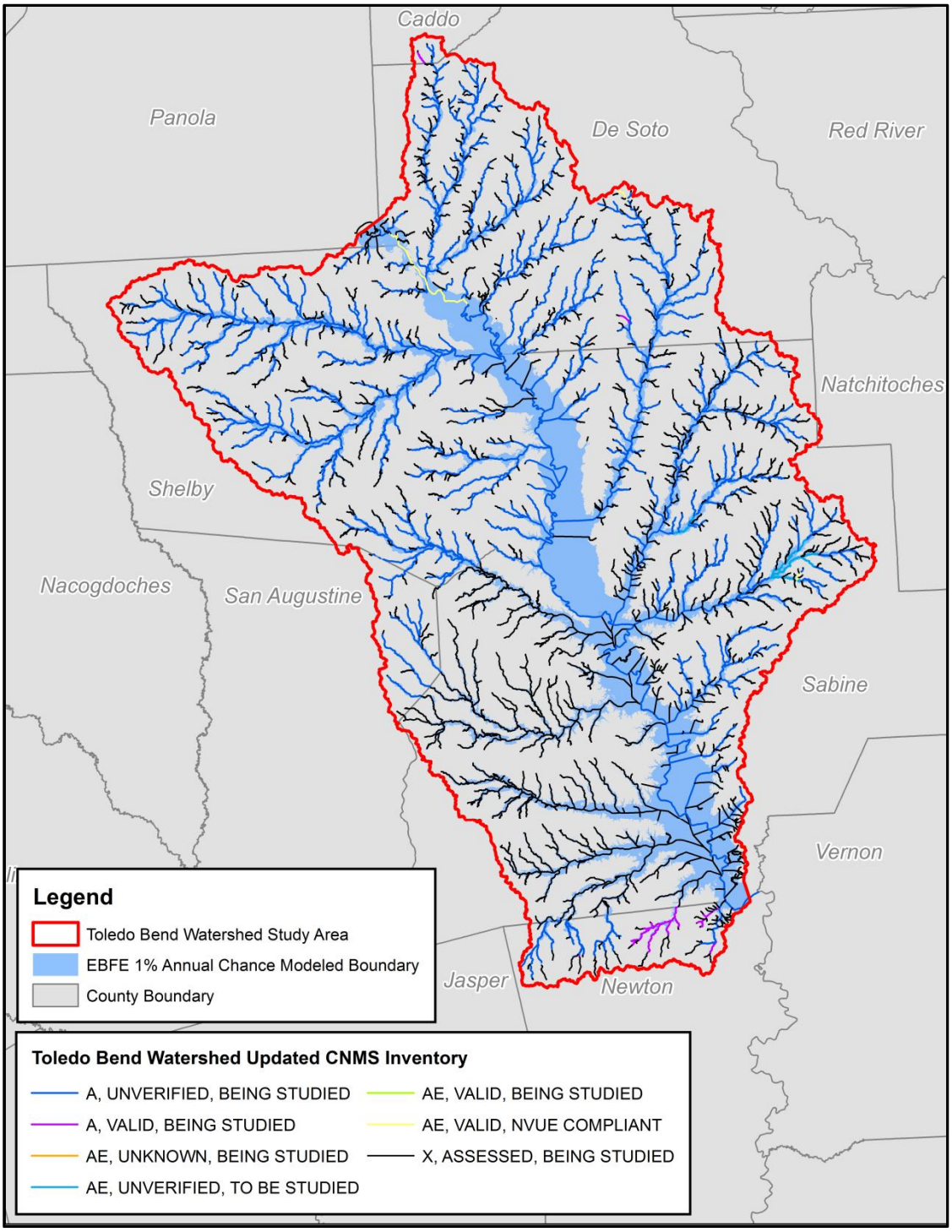
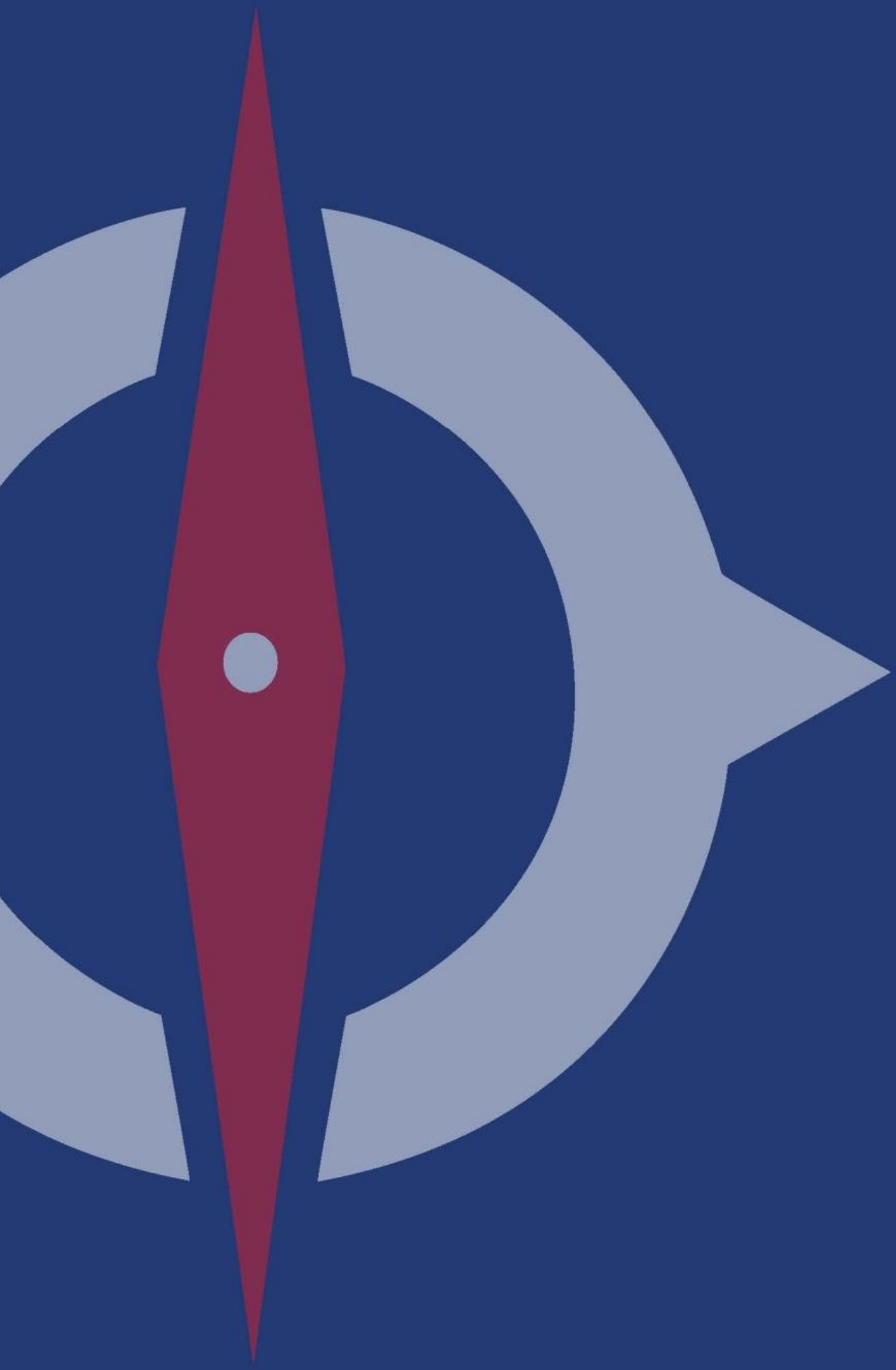
Appendix A BLE Map





Appendix IV: Resources

FEMA Points of Contact

Subject/Topic of Interest	Name	Contact Information
FEMA Region 6 Risk MAP Lead *Project Outreach*	Diane Howe Risk Analysis Branch FEMA Region 6	Phone: (940) 898 5171 Email: diane.howe@fema.dhs.gov
FEMA Technical Monitor	Dustin Busse Risk Analysis Branch FEMA Region 6	Phone: (940) 383 7214 Email: dustin.busse@fema.dhs.gov
• How to find and read FIRMs • Letters of Map Change and Elevation Certificates • Flood zone disputes • Mandatory insurance purchase guidelines • Map Service Center (MSC) and National Food Hazard Layer	FEMA Map Information eXchange (FMIX)	Phone: 877-FEMA-MAP (336-2627) Email: FEMAMapSpecialist@Risk MAPcds.com Live Chat: https://www.floodmaps.fema.gov/fhm/fmx_main.html
FEMA Project Monitor Project Outreach	Diane Howe, CFM	Phone: (940) 898 5171 Email: diane.howe@fema.dhs.gov

State Partners

Organization/Title	Name	Partner Location	Contact Information
Louisiana Water Resources Development Program *Deputy Assistant Secretary, OPW*	Patrick J Landry, P.E.	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379 3000 Email: patrick.landry@la.gov Web Page: Water Resources Program (la.gov)
Louisiana State NFIP Coordinator	Cindy O'Neal, CFM	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 274 4354 Email: coneal@dotdmail.dotd.state.la.us Web Page: National Flood Insurance Program (NFIP) (la.gov)
DOTD CTP Project Manager	Susan Veillon, CFM	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379 3005 Email: Susan.Veillon@la.gov Web Page: La DOTD - Floodplain Management Contacts
Floodplain Management Office LADOTD	Pam Lightfoot, CFM	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379 3005 Email: Pam.Lightfoot@la.gov Web Page: La DOTD - Floodplain Management Contacts
State Hazard Mitigation Officer	Jeffrey Giering	7667 Independence Blvd. Baton Rouge, Louisiana 70806	Phone: (225) 932-6300 Email: jeffrey.giering@la.gov Web Page: Governor's Office of Homeland Security & Emergency Preparedness

Organization/Title	Name	Partner Location	Contact Information
LADOTD *Statewide Flood Control Program Manager*	William J Williamson, P.E.	Public Works & Water Resources 1201 Capital Access Rd. Baton Rouge, LA 70802	Phone: (225) 379 3023 Email: billy.williamson@la.gov Web Page: Statewide Flood Control Program (la.gov)
Louisiana Department of Transportation and Development *Communications Director*	Rodney Mallett		Phone: (225) 379 1363 Email: rodney.mallett@la.gov Web Page: Administration Contacts (la.gov)

Governor's Office of Homeland Security and Emergency Preparedness

GOHSEP (la.gov)

Louisiana is a high-risk state for emergency events and disasters. The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) is the agency responsible for coordinating the state's efforts throughout the emergency management cycle to prepare for, prevent where possible, respond to, recover from, and mitigate against hazards to lessen the effects of man-made or natural disasters that threaten the state. GOHSEP can save lives and reduce property damage by understanding risks and taking action to address those risks, as well as minimizing disaster impacts and increasing the resiliency in our communities, environment, and economy.

Louisiana Department of Transportation and Development (LADOTD)

Risk MAP / CTP (la.gov)

On March 11, 2015, the Louisiana Department of Transportation and Development (LADOTD) signed a partnership agreement with FEMA Region 6 to become a Cooperating Technical Partner (CTP) in FEMA's Risk MAP Program. Since becoming a CTP, LADOTD has been diligently planning and working toward the release of updated flood risk information for Louisiana. The hope is that in the future, other stakeholders will become involved in the program to make good and efficient use of the data for floodplain management decisions and mitigation actions.

Louisiana Floodplain Management Association (LFMA)

The Louisiana Floodplain Management Association serves as a forum for parish and municipal employees, state and federal officials, and the private sector to meet and share experiences, ideas, and solutions to common flooding problems. As a grassroots effort, we assist and support each other when confronted by flooding. Flood damage reduction can best be achieved through floodplain management, that is, a balanced combination of structural and nonstructural measures. Structural measures include levees, pumps, dams, channelization, diversions, and detention/retention ponds. Of equal importance are nonstructural measures, which encompass flood insurance, federal and state legislation, voluntary relocation, local codes, emergency preparedness, floodproofing, and mitigation plans and activities.

Organization	Contact Information	Website
Louisiana Floodplain Management Association (Chairman)	Phone: 504-736-6653	Home (memberclicks.net)

Certified Floodplain Manager (CFM) Certification

The Association of State Floodplain Managers (ASFPM) established a national program for certifying floodplain managers. This program recognizes continuing education and professional development that enhances the knowledge and performance of local, state, federal, and private-sector floodplain management professionals.

The role of the nation's floodplain managers is expanding due to increases in disaster losses, the emphasis on mitigation to alleviate the cycle of damage-rebuild-damage, and a recognized need for professionals to adequately address these issues. This certification program will lay the foundation for ensuring that highly qualified individuals are available to meet the challenge of breaking the damage cycle and stopping its negative drain on the nation's human, financial, and natural resources.

CFM® is a registered trademark and available only to individuals certified and in good standing under the ASFPM Certified Floodplain Manager Program.
For more information, you may want to review these available CFM Awareness Videos:

- What is the CFM Program?
- Becoming a CFM
- What are the Benefits of a CFM?

Study materials for those interested in applying for the CFM certification can be found on the ASFPM Website at: Getting Certified (floods.org)
Check the Training & Education | Association of State Floodplain Management (floods.org) for in-person training sessions near you.
For information on becoming a member and the exam application process in the State of Louisiana visit Getting Certified (floods.org)

Interactive Preliminary Data Viewer

Risk Mapping, Assessment and Planning (Risk MAP) | FEMA.gov

To support community review of the study information and promote risk communication efforts, FEMA launched an interactive web tool accessible on-line at ArcGIS - Mapping Information Platform Studies Tracker for the project areas.
For more information on the Interactive Preliminary Data Viewer in the Region 6 area: [KS2]
Region 6 | FEMA.gov
FEMA's Flood Map Changes Viewer
Flood Map Changes Viewer (arcgis.com)

Estimated Base Flood Elevation (BFE) Viewer

As a part of the Risk MAP process, FEMA is completing **BLE** to provide a complete picture of flood hazard throughout a watershed. The BLE analysis uses high resolution ground elevation data, flood flow calculations, and fundamental engineering modeling techniques to define flood extents for streams.

To provide a look at BLE data availability and relative engineering analysis, FEMA developed the through the **Estimated BFE Viewer** for community officials, property owners, and land developers to identify the flood risk (high, moderate, low), expected flood elevation, and estimated flood depth near any property or structure within watersheds where BLE has been prepared.

Visit the Estimated BFE Viewer FEMA's Estimated Base Flood Elevation (BFE) Viewer (usgs.gov) application to learn the status of BLE in your area of interest or surrounding communities, to view the flood hazard data developed, or to utilize the tool's flood risk reporting features for a location where BLE has been made available.

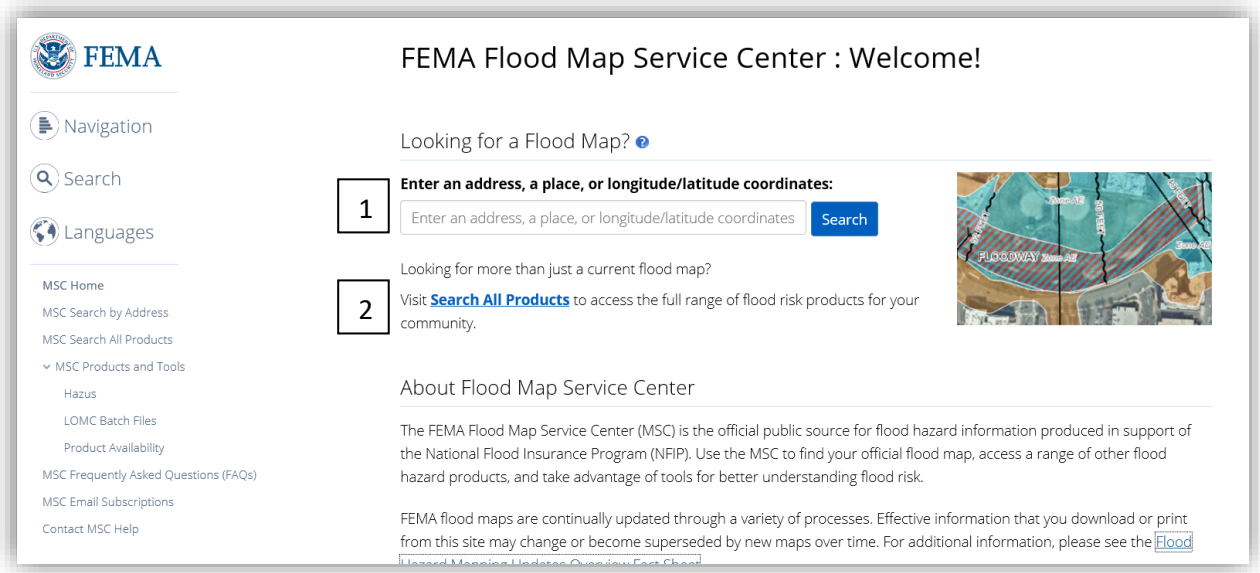
Map Service Center – Available Map Data

The FEMA Flood Map Service Center (MSC) is the official public source for flood hazard information produced in support of the NFIP. Use the MSC to find your official effective flood map, preliminary flood maps, and access a range of other flood hazard products.

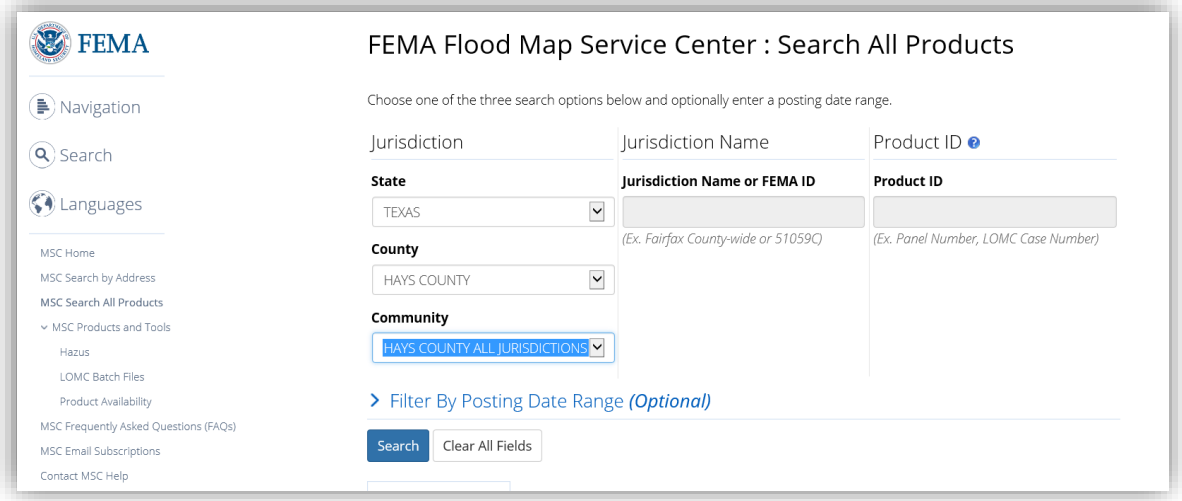
FEMA flood maps are continually updated through a variety of processes. Effective information that you download or print from this site may change or become superseded by new maps over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet.

At the MSC, there are two ways to locate flood maps in your vicinity.

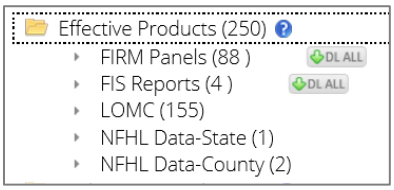
1. Enter an address, place name, or latitude/longitude coordinates and click search. This will provide the current effective FIRM panel where the location is shown.
2. Or Search All Products, which will provide access to the full range of flood risk information available.



By using the more advanced search option, "Search All Products," users may access current, preliminary, pending, and historic flood maps. Additionally, GIS data and flood risk products may be accessed through the site with these few steps.

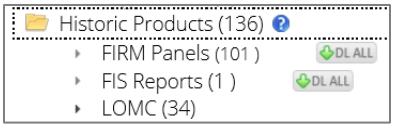


Using the pull down menus, select your state, county, and community of interest. For this example, we selected Hays County - All Jurisdictions. After the search button is selected, the MSC will return all items in the area. There are five types of data available.



Effective Products. The current effective FIS, FIRM, and DFIRM database (if available) is available through the MSC. If users click on the available effective products, they are presented a breakdown of the available products. FIRM panels, FIS reports, LOMRs, statewide National Flood Hazard Layer (NFHL) data, and countywide NFHL data may be available, as indicated in the breakdown on the right of the page.

Historic Products. A range of historic flood hazard maps, FIS texts, and LOMCs are available through the MSC.



Flood Risk Products. The Flood Risk Report, Flood Risk Map, and Flood Risk Database will be made available through the MSC once they have been compiled and completed. These products are made available after the flood study analysis and mapping have been reviewed and community comments incorporated.